RAILROAD GAZETTE

FRIDAY, OCTOBER 30, 1903.

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Contributions

Great Western Consolidation Locomotive.

October 23, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Should not the maximum tractive effort for the Great Western consolidation described in the *Railroad Gazette* Oct. 23, be 29,773 lbs. instead of 31,524 lbs., with an M. E. P. of 85 per cent. of the boiler pressure?

LAWFORD H. FRY.

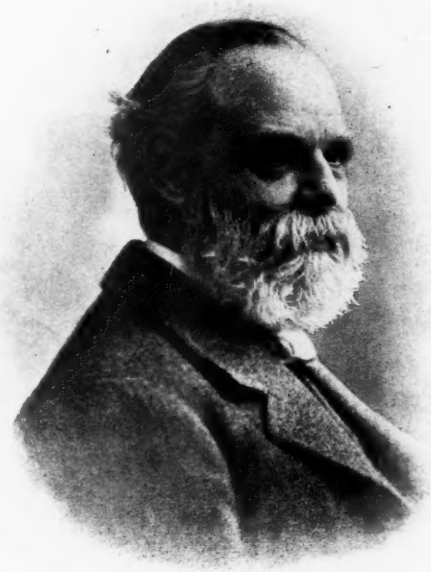
The tractive effort as given is calculated on 90 per cent. of the boiler pressure. The use of this percentage is common in England.—EDITOR.

Robert Henry Thurston.

It is with profound sorrow that the engineering profession and a host of friends learn of the death at his home in Ithaca, N. Y., on Oct. 25, of Professor Robert H. Thurston, Director of Sibley College, Cornell University. While sitting in his library at 6 p.m. awaiting the coming of ex-President Andrew D. White and a few professors of the university to a dinner celebrating his 64th birthday, he became unconscious and expired from heart disease shortly afterwards.

Prof. Thurston was born in Providence, R. I., on Oct. 25, 1839. His father, Robert L. Thurston, of the firm of Thurston & Gardner, was one of the early steam-engine builders of the country. In the fifties the firm was in active competition with George H. Corliss in introducing automatic cut-off engines. In the shops of this firm, which are now the shops of the Rice & Sargent Co., young Thurston got his early mechanical training. He took the course in civil engineering in Brown University, graduating in 1859 with the degrees of C.E. and Ph.B. The degrees of A.M. and LL.D. were afterwards conferred on him by Brown, and in 1885 the Stevens Institute of Technology conferred on him the degree of Doctor of Engineering, then granted for the first time. He worked in his father's shops until the war broke out, in 1861, when he received an appointment as assistant engineer in the Navy. He served throughout the war in different vessels on the Atlantic coast, and became chief engineer of one of the monitors. From 1865 to 1871 he was instructor in the Naval Academy at Annapolis, and in the latter year he was called to the professorship of mechanical engineering in the Stevens Institute of Technology. Stevens Institute was a school without a precedent. Edwin A. Stevens had left a fund of about $600,000 to endow an "institution of learning." The trustees, under the will, decided that it should be an "Institute of Technology," and selected Dr. Henry Morton, then Secretary of the Franklin Institute of Philadelphia, for its president. Dr. Morton suggested that the institute should be a special professional school of mechanical engineering, and thus was begun the first of those splendid institutions which are now to be found in every State, usually as departments of universities. Dr. Morton selected Prof. Thurston for the chair of mechanical engineering, and then began Professor Thurston's remarkable career as teacher, author, investigator and organizer. For 30 years his work in these lines has been incessant. He has had under his immediate supervision a greater number of professors, instructors and students in engineering than any other man ever had; has been a voluminous writer of books, technical papers, and articles on a variety of subjects in magazines and newspapers; was always carrying on some scientific research either in the laboratory or in the study, and found time to deliver many public addresses and to attend conventions. Professor Thurston's work in the Stevens Institute of Technology lasted 14 years, or until 1885. In addition to his teaching work he organized a testing laboratory with apparatus and a corps of assistants for all sorts of mechanical tests. He made many boiler and engine tests, was United States Commissioner to the Vienna Exhibition in 1873, and edited the four volumes of the reports of that exhibition, writing one of them himself; and was secretary and most active member of the United States Board appointed to test iron, steel, etc., from 1875 to 1878. His pace was then too strong. In 1877 he had a bad attack of nervous exhaustion, from which he did not recover until he had taken about a whole year's complete rest at the sanitarium in Dansville, N. Y. He returned completely cured, and during the rest of his life enjoyed fairly good health.

In 1885 the trustees of Cornell University were looking around for a man to take the chief position in the Sibley College of Mechanic Arts, which was then in rather a moribund condition, and they came to Prof. Thurston for advice. He recommended several men for the position, whose claims were duly investigated. Finally President White came to Prof. Thurston and said, "Well, we have found our man; we have looked over all the men you have named, and you are our man." So Professor Thurston went to Cornell, and under his splendid management Sibley College became a college of mechanical engineering, the most important department by far of the university, and the largest college of its kind in



R. H. Thurston.

the world, its roll of students this year numbering nearly 1,000.

In 1880 Prof. Thurston was one of the founders of the American Society of Mechanical Engineers, and was its first president. He was a member of the American Society of Civil Engineers, the American Society of Mining Engineers, Fellow and First Vice-President of the American Association for the Advancement of Science, and a member of many foreign societies. He was a member of the jury of the Paris Exhibition of 1889, and while in Europe that year with the excursion of American engineers made the address in response to the address of welcome in the hall of the Institution of Civil Engineers in London.

He was the author of numerous technical books which are classics in their respective fields of research. Of these, his "Materials of Engineering" and "Manual of the Steam Engine" are perhaps his best known works. The former was compiled while he was at Stevens Institute and is one of the most complete treatises on the strength of materials ever written. An abridged edition of this work under the title of "Materials of Construction" has been largely used as a text book in colleges and universities. Some of his other writings were "Steam Boiler Construction and Operation," "Boiler Explosions," "Friction and Lost Work," "Stationary Steam Engines" and "Life of Robert Fulton." Those who knew him only through his books will feel the loss to the world of a painstaking and careful author who manifested a keen sense of perspective in his writing and who was never satisfied to leave a thing half hidden in darkness or ambiguity when patient investigation would reveal the truth.

In personal qualities Prof. Thurston was no less distinguished than in his professional achievements. One of the most affable of men, he had a personal magnetism that drew to him hosts of friends. The number of his students now runs up into the thousands. Many of them are now gray haired men, and they remember with affectionate gratitude his kindly qualities more than they do his teaching. His loss to the profession at large is equalled by his loss to his personal friends. He leaves a wife and three daughters, the eldest of whom is married to Prof. Coffin, of the University of Wisconsin.

Samson Fox.

A cablegram from Walsall, Staffordshire, England, October 24, announces the sudden death of Mr. Samson Fox, Chairman of the Leeds Forge Company, of Leeds, England, and the father of the pressed steel car industry. Mr. Fox had been in the United States only three weeks ago on matters connected with the development of his business. He was born in Leeds about 64 years ago. He built up the Leeds Forge Company and was the inventor of the corrugated flue for boilers, used extensively in the British Navy. The first pressed steel trucks ever built were made by Mr. Fox, at Leeds, for a narrow gage railroad in India. One of these trucks was brought to the United States and was exhibited at the Master Car Builders' Association convention at Alexandria Bay (Thousand Islands) in 1888. This truck was an excellent piece of workmanship and of course attracted much attention.

Mr. Fox first came to the United States in 1887, and, in connection with Illinois Steel Company interests, built works at Joliet, Ill., to make the Fox steel truck; and thus was begun the extensive pressed steel car industry which has been such an important factor in the great reduction in the cost of transportation that has taken place in the United States within the last 10 years. Another plant was built in Pittsburg in 1896; and the following year, 1897, the Fox Solid Pressed Steel Company was formed by the consolidation of the Joliet and Pittsburg plants. The Pressed Steel Car Company was formed by the consolidation of the Fox Pressed Steel Company and the Schoen Pressed Steel Company, early in 1899.

Mr. Fox was married twice and leaves one son and two daughters. One of the latter is the wife of Bernal Bagshawe, at one time General Manager of the Fox company in this country, and now with the Leeds Forge Company. Mr. Fox's home at Harrogate, Yorkshire, was known as Grove House, but he also had an estate at Walsall, Staffordshire, for which place he was a candidate for election to the British Parliament.

At Grove House Mr. Fox had built a private workshop, equipped with elegant tools in great variety, and here he took his recreation. He was lovable and generous while at the same time possessed of the sturdy virtues which make a conservative business character. He had a wide circle of business friends, but he was liked by no class more than by his employees.

Foreign Railroad Notes.

Colombia, in South America, has granted a concession to J. T. O'Bryan and Charles S. Wright, of the United States, to build a railroad to connect Medellin, Colombia, with the lower Magdalena River and with the department of Cauca at Saint Lucia, a distance of 180 miles. The road will eventually be continued from Medellin to the head of the Porce, a distance of 12 miles additional.

Freight rates on water, not mineral water, but the ordinary compound of oxygen and hydrogen with which potatoes are boiled and clothes washed, and which some people drink, have been found too high on an Austrian railroad from Spalatro, on the Adriatic, and a reduced water tariff has been issued. The line runs through the "Karst," where the rain runs through a limestone formation and drains away in subterranean streams too deep to be easily reached.

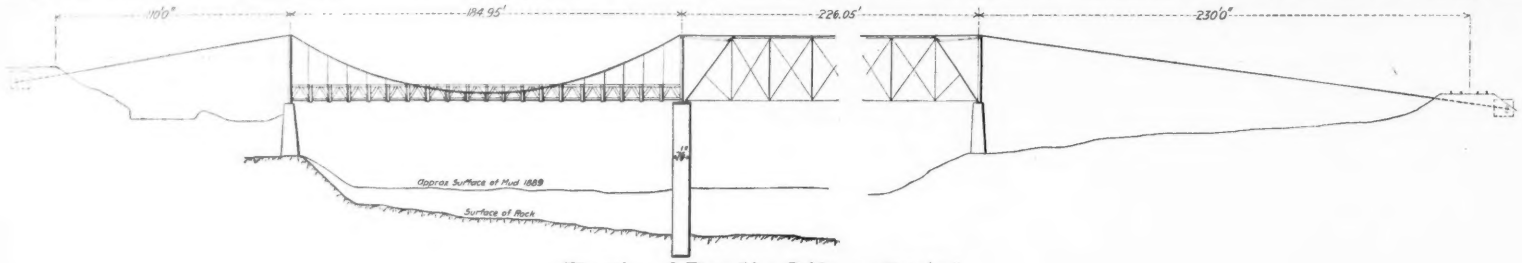
Bavaria, which is not quite so big as South Carolina, but has more than 6,000,000 inhabitants and about 6,250 miles of railroad, nearly all belonging to the State, is to have a Minister of Transportation, who will not only have charge of the State Railroads, but of a little canal and river and lake navigation, the post-office, telegraph and telephone service, and the oversight of private street railroad and other transportation enterprises. These affairs have heretofore been in the hands of departments of a ministry which had charge of other affairs, especially foreign affairs. Greater simplicity and directness is to be aimed at under the new ministry.

Last May as a through train was standing at a station in Berlin to let off passengers, a suburban train ran past the signal into the rear end of the through train and killed one man and injured several others. The engineman was arrested and tried in the first week of October for causing death by neglect. His defence was that as he approached the signal he suddenly became dizzy and could see nothing until he was almost on the train. The doctors found nothing the matter with him, however; he had before caused two slight accidents from lack of presence of mind, and the court sentenced him to nine months imprisonment, perhaps holding that when an engineman finds that he can't see, especially on entering a station, he ought to stop or give the fireman his place; as to which the engineman (in Germany) would probably reply that the regulations don't say so.

The Kansas City Flow-Line Bridge Repairs.

BY J. A. L. WADDELL.

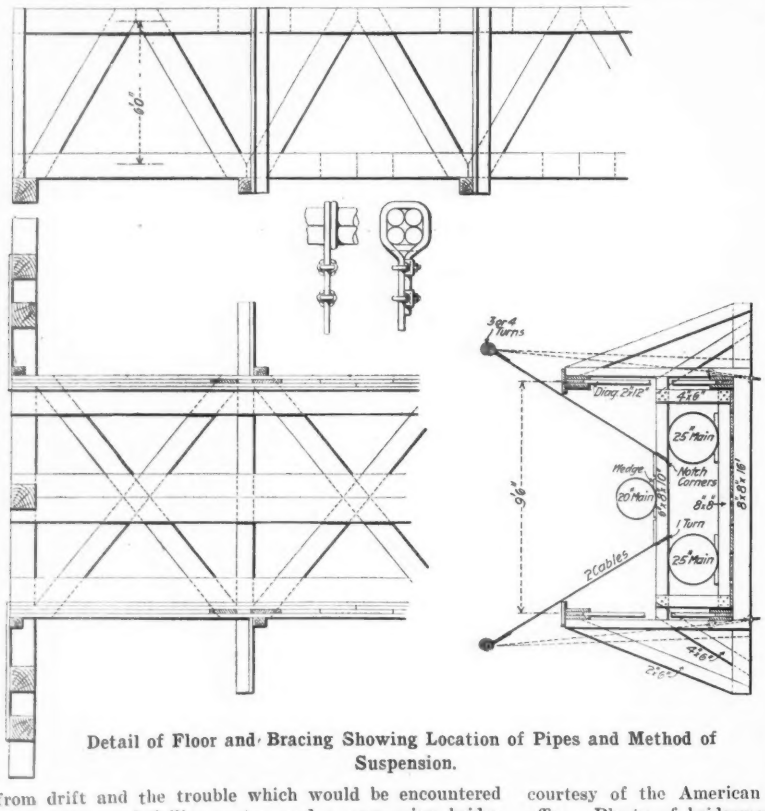
One span of the bridge over the Kaw River that carries the pipes for the water supply of Kansas City, was destroyed, and the other badly injured, by the great flood of May 31, 1903. The bridge was located a short distance from the river's mouth and consisted of two steel Pratt-truss spans of a rather antiquated type, the floor-beams being suspended, resting on two masonry abutments and one cylinder pier. The abutments were not used for retaining earth. The center pier was well built and consisted of two 7 ft. iron cylinders sunk into bed rock by the pneumatic process, well sway-braced, and filled with concrete. The span that went out was 185 ft. long and the one that remained was 226 ft. The upstream truss of the latter was crippled in three vertical posts near mid-span and in the bottom chord; and the floor-beams, hangers, and sway bracing were badly wrecked, rendering the span unsafe. During the extreme height of the flood the water came up to the cross-girders, but did not quite reach the bottom chords. An accumulation of driftwood did most of the damage.



Elevation of Flow-Line Bridge as Repaired.

The shorter of the two spans was carried away about 6 o'clock on Sunday evening, causing a most serious crisis. The water supply of the city was almost entirely shut off, the small amount of water that for a short time was pumped from the Kaw River being so seriously contaminated that it was condemned by the City Chemist as absolutely poisonous and the entire city was at the mercy of fire. Owing to the failure of the water supply, the street cars stopped running; the sewers fouled for want of flushing; the general use of water-closets throughout the city had to be abandoned; the gas supply for a time was stopped; and the electric light plant was forced to shut down.

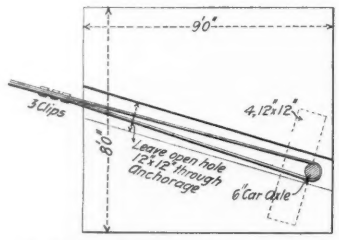
At 10 a.m. on June 3 the writer met the Mayor and received from him instructions to prepare a plan to build, regardless of expense and in the shortest possible time, some kind of a structure which would carry safely the pipe and its load of water, and thus relieve the situation. Mr. W. G. Goodwin, Superintendent of Water Works, and his assistants, were debating whether it would be better to build a pontoon or a suspension bridge, a pile structure being deemed out of the question. The idea of a pontoon bridge was abandoned because of the danger from drift and the trouble which would be encountered from rising and falling water, and a suspension bridge was decided on.



Detail of Floor and Bracing Showing Location of Pipes and Method of Suspension.

During the forenoon arrangements were made for the use of a large steamer for the purpose of visiting the wreck and determining the conditions, but although the water had fallen considerably, it was still almost up to the floor of the remaining span; and the current was so swift that the steamer was unable to make any headway against it. It might have been practicable to reach the structure by floating down against it in a small boat, but the risk involved was great, so it was not attempted. However, barring the actual condition of the remaining span, all the information required for rebuilding the bridge as a suspension span was collected.

One anchorage was located upon the high ground in the street on the west bank, and the other adjacent to a railroad embankment which formed the approach to what had been the Chicago Great Western bridge. As the river was almost at the level of the top of this bank, it was necessary to construct the anchorage in the water, running the back stays through the embankment close to the rails. These back-stays were carried from the center pier along the top chords of the remaining span, being supported over the pier and east abutment by timber bents. One of these was required also over the west abutment. By carrying the cables along the top chords and by making the timber bents of the same height as its trusses, the crippled span was not called upon to sustain any stress from the suspension span except to support a small portion of the weight of the cables lying thereon.



Section Through Cable Anchorage.

Kansas City at this time was practically cut off from the outside world as far as freight transportation was concerned; consequently it was necessary to procure all the materials for the bridge from local dealers. For two or three days there had been a large demand for timber to be used in various kinds of repair work, and it was therefore impossible to procure the large timbers needed and the engineers were forced to figure on building many of them out of planks. For main cables, it was necessary to adopt some second-hand 1½ in. wire ropes belonging to the Metropolitan Street Railway Company, which had been used at one time by the cable roads and had been stored away. It was estimated that they still retained one-half of their original strength, or 50,000 lbs.; and they were loaded about one-third of that amount. For suspenders a supply of new ½ in. wire rope was found said to have an ultimate strength of four tons. This it was decided to use with a factor of safety of about four. Unfortunately, as was learned later on, a mistake had been made concerning the strength of this rope, which nearly caused serious trouble. For other metal, the Riverside Iron Works Co. put their stock and shops at the disposal of the engineers, Messrs. Waddell & Hedrick.

An ample supply of Portland cement was obtainable, although great quantities of it had been ruined by the flood, most of the cement houses being located on the river bottoms. A supply of good sand was found close to the east end of the bridge, having been stored there by one of the railroad companies. This became available as the water level fell. Broken stone could be obtained in the city and barged to the site with the aid of steamers, and plant and tools were furnished through courtesy of the American Bridge Co., from their local office. Plenty of bridgemen and laborers were at hand, owing to the cessation of work caused by the floods.

By working until after midnight with candle light the pencil drawings and bills of materials were finished, and early next morning (June 4) the report to the Mayor was handed in; but as it had to be acted upon by the City Council, it was not until nearly 4 o'clock that the engineers were empowered to go ahead. By 6 o'clock all the materials were ordered, and some of them were started by wagon to the temporary steamboat landing at the foot of the Fourth street viaduct; barges and boats were secured for transportation; and workmen were ordered to report early next morning at the site.

Early the next morning (June 5) work on the west anchorage was begun. By 7 o'clock wagons containing timber, cement and broken stone were lined up at the landing waiting for the barges. As soon as these appeared they were loaded, and the materials were transported to the site of the east anchorage, where a small amount of dry land on top of the embankment had begun to show itself above the water. On this the materials were stored, and by noon the construction of the coffer dam was begun. A small pile driver was quickly made, and a coffer dam of two rows of sheet-piling with clay between was built, concreting therein being started about midnight of the same day, as the pile driving was finished at 9 o'clock.

By working continuously, the entire anchorage was completed at 1 o'clock of Saturday afternoon, June 6. Meanwhile the construction of the west anchorage was being continued and it was completed at 7 a.m. of Saturday, June 6.

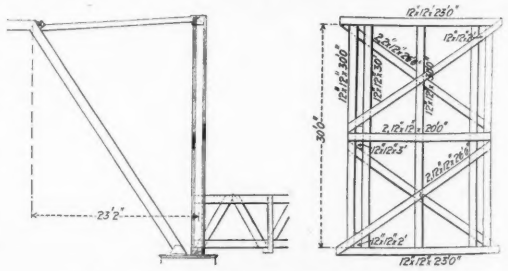
The structure that was to be built consisted of eight second-hand steel cables, four per side, having a deflection of about 24 ft. These rested on the timber bents over the center pier and west abutment. Each bent consisted of five 12 in. x 12 in. verts, a 12 in. x 12 in. cap, and a 12 in. x 12 in. sill, sway-braced on both sides with 4 in. x 12 in. planks. On top of the cap near each end was placed a saddle formed of a rounded 12 in. x 12 in. timber covered with a ½-in. steel plate. The suspended span is divided into 20 panels of 9 ft. 3 in. each, the suspender cables being wrapped around the main cables and having their ends secured by three standard clamps each.

These suspenders are attached at their lower ends by thimbles, to beam hangers that run at a slight angle to the vertical through the floor-beams, each of which is a single 8 in. x 8 in. x 16 ft. yellow pine timber. On top of the beams run longitudinal floor planks, and these are swayed beneath by crossed planks spiked thereto.

The stiffening trusses, which are spaced 9 ft. 6 in. from center to center, are 6 ft. deep between centers of chords. They are built entirely of 2 in. x 12 in. planks, excepting the verts, which are 4 in. x 6 in. timbers. The top chords are side-braced to the floor-beams, it having been originally the intention to adopt pony trusses; but after the pipes were laid, as a matter of precaution and to obtain additional lateral rigidity, an overhead system of horizontal sway bracing was added. The pipes rest on shims of 8 in. x 8 in. timber placed directly over the floor-beams.

The accompanying drawings illustrate the bridge as rebuilt. It is to be noted, however, that the plan shows an additional pipe carried by the structure and the strengthening of the latter for same. Further reference to this will be made. One of the photographs herewith shows the finished bridge, and illustrates quite clearly most of the features and details mentioned. The main cables pass around a 6 in. car axle that rests against four 12 in. x 12 in. timbers all embedded in the concrete, and are then carried outside of the anchorage where they are connected by standard clips. The timber bents over the pier and the east abutment are stayed to the portals of the old span by timbers well bolted at each end. This bracing gave some trouble when adjusting the cables, but it was overcome without much difficulty.

The material for the bents was framed on Friday night and Saturday forenoon. It was necessary to build



Detail of Cable Support at End of Truss.

most of the large 12 in. x 12 in. timbers of 2 in. x 12 in. planks well spiked together. The timbers for the stiffening trusses were framed on Saturday, during the night. By Sunday morning the bents were erected, and during that day the cables were unloaded and inserted into the west anchorage. By sundown one cable had been carried across, and during the night three more cables were put in place. One of them, unfortunately, had been cut too short; so it was necessary to splice it. About 9 o'clock the remaining span of the James street bridge, which was situated a short distance up stream from our

work, went out with a loud crash and a roar of water, frightening the workmen to such an extent as to cause a stampede for the shore.

The floating floor system came perilously close to the deck of the old span, but it passed without lodging. The accident was caused by the undermining and partial wrecking during the flood of the east abutment on which it rested.

On Monday the remaining main cables were strung, and before midnight they were all adjusted to practically the same tension. During the previous day a large force of men had been at work on the old span, putting in temporary wooden stringers and repairing the floor so as to make it strong enough to carry the pipes and their load of water; but nothing was done to strengthen the crippled up-stream truss. This floor-repair work was continued until about 1 o'clock in the morning, when the foreman in charge thinking that the injured posts were failing, called his men off the bridge, and in consequence no work was done during the remaining hours of darkness. Soon after daybreak, by offering double pay until it was strengthened and by pointing out that the engineers would remain upon it until the posts were reinforced, a few of the men were induced to resume work, but many of them held off until after the wooden posts were in place.

The first thing done was to relieve the largest and most injured of the three bent verts by placing alongside two timbers bearing at the top on a timber shim inserted beneath the upper chord and at the bottom on a similar shim resting on the chord bars. During the day both the top and bottom chords were stayed by guyropes to the old water works building, because the bottom chords had been bowed out of line by the drift, and the men were afraid that the span would fail by increased buckling.

By sundown a working platform had been built and essary immediately to reinforce the suspenders, and they were tripled, instead of doubled, partly because of difficulty in distributing the load.

Pipe laying was begun about 3 p.m. on Thursday, and early Friday morning the pipes were all laid and connected, although the supporting shims were not all in and a number of the suspenders had not been strengthened. Mr. Goodwin had been notified not to turn the water on until after all was ready, and he so instructed his assistants. However, one of them without consulting anyone, on learning that the pipe was connected, telephoned to Quindaro to turn on the water. The result was that three of the weak suspenders snapped with a loud report, and the breaking of the others and consequent destruction of the entire span appeared imminent. Fortunately, the strengthened suspenders had not been put in consecutively but were distributed with some regularity over the whole span. These upheld the load. The water was soon turned off and by opening some valves the pipes were quickly drained and operations were resumed. Had all the shims been in place so as to distribute the load over all the floor-beams, the mishap would not have occurred; because the rope, though weak, had more than sufficient ultimate strength to carry the load when uniformly distributed.

The old pipes that were used leaked badly, and had to be plugged with wood. They still leak somewhat, but the amount of water thus lost is inconsiderable.

It did not take long to replace the broken suspenders and to strengthen those that had not been reinforced, so by noon the water was turned on again, and the situation throughout the city was relieved. The actual construction of the span occupied just one week; which, considering all the adverse conditions, is not a bad record. These conditions can readily be imagined. Materials were scarce, the nearest telephone of any account was

Flow-Line Bridge During Repairs, Showing James Street Bridge.

Completed Span of Temporary Flow-Line Bridge.

suspended from the cables at the west bent by means of ropes and pulleys. The small suspender cables with all the necessary tools for fastening them on were placed upon this platform, and then four workmen and an engineer got aboard and were pulled across the river from the other side, fastening the suspenders at the proper intervals as they went along. This occupied the entire night. As fast as the suspender cables were fastened on, the cross-beams were hung at their lower ends, and early in the morning (Wednesday, June 10,) planks were laid on the beams so that the workmen could walk over.

Work on the stiffening trusses was begun on the same afternoon from both ends, and Thursday and Thursday night were occupied in finishing the stiffening trusses, laying flooring and shims for the pipes, and adjusting the height of the floor. In respect to the latter a change was made in the plans against the advice of the engineers; for Supt. Goodwin, seeing that a camber of 4 ft. had been left in, insisted on lowering the beams 2 ft. at mid-span, asserting that, unless this were done, it would be impossible for him to connect his pipe. Although it was the opinion of the engineers that the weight of the pipes and their contents would be sufficient to take out nearly all of the 4 ft. camber, the ordered change was made, with the result, as shown in the accompanying photograph, that there is now a reverse camber of about 18 in. This really does no harm, but looks ugly. Of course it is practicable to take up the sag by means of the adjustments in the main cables.

These adjustments were designed by Mr. Hedrick, and consist of a pair of heavy 15 in. channels placed back to back with a space of 3 in. between, through which pass short screw bolts having a nut at one end and an eye at the other for the attachment of the cable, the bolts acting alternately in opposite directions. While the suspender cables were being attached, their great pliability caused a suspicion that they did not have the estimated strength, and this was corroborated by the breaking of a piece of cable used on the work. By investigation it was found that the dealer who supplied the cable had made a mistake in obtaining its strength from his tables, and had furnished rope of only one-half the capacity figured upon. In consequence of this discovery it was nec-

half a mile from the work, means of transportation were difficult to obtain, the men operating the two naphtha launches employed in rebuilding the bridge, although under contract with the city, deserted continually in order to earn large pay by ferrying passengers, and food for the workmen was hard to get. Arrangements for the delivery of lunches were made both by telephone and by personal interview, but no dependence could be placed on promises to supply food, owing to the great demand throughout the entire city, and on one occasion, when the men were without food, a city official's horse and buggy were requisitioned and a personal canvass was made of hotels and restaurants by the writer, no refusals being accepted. To get the supplies thus obtained to the launch on the river, a wagon labeled "Water Works" was appropriated almost by force, against the protests of the driver, for everything else on wheels was in service.

What the repair work cost no one has yet figured. In buying the materials the engineers seldom asked the price; but when they found anything they needed, they ordered it sent to the site immediately, regardless of the cost of transportation. More men, twice over, were employed than would be used ordinarily on similar construction. Of course they were not handled economically; but there were usually plenty on hand whenever needed. The night work was very expensive, not only because of the small output per man, as compared with day labor, but also on account of the higher wages paid.

The work was by no means finished when the water was turned on, for the old span had been strengthened only enough to make it safe temporarily. It was still necessary to put in one new floor-beam, a number of new beam hangers, many new steel stringers, and an entirely new wooden floor, also to strengthen several injured floor-beams and to repair the east portal bracing, which had been broken by the pressure from accumulated drift. Soon after the water works were again in operation it was decided to lay another pipe-line over the bridge and to strengthen it for that purpose. For this additional work new main cables were procured at St. Louis, and laid alongside the others, carrying the new pipe on additional 6 in. x 8 in. floor-beams placed above the existing cross-girders, as indicated on the large-scale sectional drawing.

In concluding this paper the writer desires to give credit in full where credit is due, and especially mention Mr. Hedrick, Messrs. Ash and Cochrane, and Messrs. Allen and Haus von Unwerth, among the engineers; the Stewart-Peck Sand Co., which loaned floating equipment managed and directed by R. W. Waddell, and several other individuals. Comment should also be made on the hardihood and pluck of the bridgemen.

Concerning the appearance and character of the repaired bridge no apology need be made, although it is in no sense either handsome or first-class. To make it either, under the circumstances, would have been out of the question. It is doing its duty to-day satisfactorily; and all that its designers and builders now desire concerning it is that it be replaced within a reasonably short time either by a tunnel beneath the river-bed, or by a scientifically-designed and well-built bridge.

Railroad Construction in Oklahoma.*

During the past 18 months the writer has been in charge of about 60 miles of new railroad construction, on which were built a number of different structures, some of them not usual in new railroad work in the west. It would be proper to state that there is no claim for originality in the plans, many of them being merely modifications of the standard plans of the road, the others having been used elsewhere by other members of the engineering profession. All the construction described is on a portion of a line being built by the Atchison, Topeka & Santa Fé from Newkirk, Oklahoma (a point 14 miles south of the Kansas State line), to Pauls Valley, Ind. T.

As it is intended to use the new line for heavy freight traffic, the maximum gradient adopted was 0.6 per cent., compensated for curvature at the rate of 0.05 per cent. per degree.

The sharpest curve allowed was of 4 deg., all curves of 3 deg. and more being spiralled by the six-chord spiral, a modification of a parabolic curve originated by Mr. J. R. Stephens, Engineer in Charge of Construction, the grading being cross-sectioned and built on the offsetted curves.

Degree of main curve.	Length of terminal curve, in ft.	Degree of terminal curve.	Terminal angle.	Offset, in ft.
3 deg.	100	1 deg. 30 min.	1 deg. 30 min.	0.65
4 deg.	120	2 deg. 00 min.	2 deg. 24 min.	1.25

For intermediate curves, intermediate values were taken. The length of the terminal curve is exactly divisible by four, to avoid fractions in the chord lengths. The terminal curve has a radius of twice the length of the main curve; the spiral is half as long again as the terminal curve, one-sixth running back on the tangent, four-sixths consuming the terminal curve, the remainder being on the main curve.

The line leaving Newkirk runs across drainage for the first eight miles, so that some heavy grading was necessary, and a number of openings were required; for the rest of the way, to the first crossing of the Arkansas River, the location is along drainage lines presenting no unusual features. In this first section the entire country consists of a thin soil over-lying solid limestone, which can be drilled and quarried easily to any dimension, and which cuts perfectly. This stone hardens on exposure to the air, and is not shattered by frost.

The original plans called for wood-box culverts, but, on account of stone being obtainable and the line being built for heavy traffic, the Chief Engineer, James Dun, changed all the pile trestles which had sufficient headroom to arches and the wood boxes to masonry culverts. A contract for the masonry was let to L. W. Lewis, of Emporia, Kan., at the following prices per cu. yd.:

Bridge masonry	$5.75
Rubble masonry	3.15

*A paper by A. G. Allan, published in the August Proc. of the Am. Soc. C. E., pp. 615-626, and presented to the Society Oct. 21, 1903.

Rubble arch masonry	5.25
Paving	3.15
Coping steps and ring stones	6.50
Box culvert rubble masonry	3.15
Box culvert rubble dry	2.50
Covering stone for box culverts	5.25
Concrete in foundations	3.00
Earth excavation above water	.35
Loose rock excavation above water	.50
Solid rock excavation above water	1.00

All excavation below water at cost plus 10 per cent. for use of tools and supervision.

Overhaul on all stone more than one mile from the site of the work, 40 cents per cubic yard additional to above prices for each mile after the first mile.

The railroad company furnished the cement, f.o.b. cars, and the contractor furnished the sand, but the company paid the actual cost for hauling the sand and cement from the cars to the site of the work. The railroad company also furnished transportation for men, teams, tools and material to and from the work.

The excavations for the foundations were commenced during the first week in May, and the last masonry was finished in October, all sand being teamed from two to 15 miles at a cost varying from $1.40 to $3.25 per cu. yd.

The cement used was manufactured by the Iola Portland Cement Company of Iola, Kan., and showed the following tensile strengths, from tests at the factory:

Neat Cement (20 per cent. Water).

1 day	204-228 lbs. per sq. in.
7 days	630-657 lbs. per sq. in.
28 days	745-761 lbs. per sq. in.

Cement with 3 Parts Sand (10 per cent. Water).

7 days	206-230 lbs. per sq. in.
28 days	310-335 lbs. per sq. in.

Owing to continuous wet weather and high water in the creeks, it was found almost impossible to separate wet and dry excavation, so that the entire foundation work was done by the contractor on "force account," under the close supervision of the writer and two timekeepers, each detailed to certain jobs. The cost of this excavation varied so much, on account of the different causes, pumping and floods, that it was extremely difficult to get at the exact cost per cubic yard. An average of five different jobs, including pumping, was 45 cents per cubic yard.

The cost of masonry, including the excavation for changing channels and for foundations but excluding the cost of cement and sand, was based on a scale of unit prices as follows:

	Unit prices per cubic yard. Box culverts.	Arches.
Concrete	$3.00	3.00
Arch rubble	...	5.25
Coping, steps and rings	6.50	6.50
Overhaul	...	.40
Dry rubble	2.50	2.50
Excavating new channel	...	.15
Rubble masonry in cement	3.15	...
Paving	3.15	...
Covering	5.25	...

The foundations for the arches were, soapstone, quicksand, solid rock and gravel and rock, and the sizes of arches varied from 8 ft. x 4 ft. to 24 ft. x 10 ft., and the lengths from 22.64 ft. to 50.03 ft. The total cost per lineal foot was as follows:

Size of arch.	Cost per lineal foot.
12 ft. x 4 ft., 22.8 ft. long	$61.10
10 ft. x 6½ ft., 50.03 ft. long	48.39
24 ft. x 10 ft., 28.67 ft. long	168.88
Double, 14 ft. x 5½ ft., 31.41 ft. long	91.88
10 ft. x 5 ft., 22.64 ft. long	58.67
8 ft. x 4½ ft., 49.62 ft. long	39.96
6 ft. x 5 ft., 49.11 ft. long	37.80

The sizes and cost per lineal foot of the box culverts was as follows:

Size.	Cost per lineal foot.
3 ft. x 3 ft. dry box, 24.5 ft. long	$8.76
4 ft. x 6 ft. dry box, 41.06 ft. long	12.02
4 ft. x 6 ft. rubble box, 28.1 ft. long	14.07
2 ft. x 2 ft. dry box, 69.57 ft. long	5.30
3 ft. x 3 ft. dry box, 22 ft. long	10.94

The cost of the cement and sand varied with the length of the haul from the river or nearest unloading point, the sand costing from $1.40 to $3.25 per cu. yd,. delivered, the larger amount being for sand used on work 15 miles from the river. The average cost of hauling the cement, for six different jobs, was $0.40 per barrel, the average load being 28 sacks, or seven barrels. This high average was due to the wet weather and, consequently, the bad condition of the roads.

Most of the arches were founded on solid rock, soapstone or other hard material; but one, viz., the 10-ft. arch at Station 2425 + 40, was built on quicksand. In making the foundation excavation for this arch the men sank to their knees. The bottom being too soft for the regular foundation plan, the writer obtained authority from Mr. Stephens to build the masonry on a concrete base on a grillage of old piling, drift-bolted together, to form a solid floor. This base is 52 ft. long, 20 ft. wide and 2½ ft. thick, weighing approximately 250 tons. It settled about 0.4 ft. before the masonry was commenced. There has been no further movement that could be determined.

The stone for the concrete was broken by hand into pieces small enough to pass through a 3-in. ring, the breaking being done on the site of the work. The stone for the concrete was entirely free from dirt. The sheeting and ring stones were laid with ½-in. joints. The joints were made on the radial lines, and the faces of the sheeting stones were hammered so as to make a close fit on the lagging. No joints closer than 12 in. were allowed, and each stone was the full depth of the arch. The entire ring was pointed after the centers had been removed. The cement hardened rapidly, so that it was not necessary to leave the centers in very long after the ring had been turned. Centers were never removed, however, in a less number of days after the masonry was completed than the number equaling the diameter of the arch in feet.

In almost every case the creek channels crossed the right of way at an angle; therefore, channel changes were made to admit and discharge the water freely. A great deal of the material from the excavation thus made was utilized in building the embankments.

All the masonry was laid out on a grade. The writer believes in setting boxes on a grade of not less than 1 per cent. The largest arch built was set on a grade of 1.25 per cent. The work was done on a 10-hour-day basis and the scale of wages paid is as follows:

	Cents per hour.
Mason foreman	40
Masons	35
Quarrymen	25
Mortar mixers	20
Labor	17½
Teams	32½ to 35

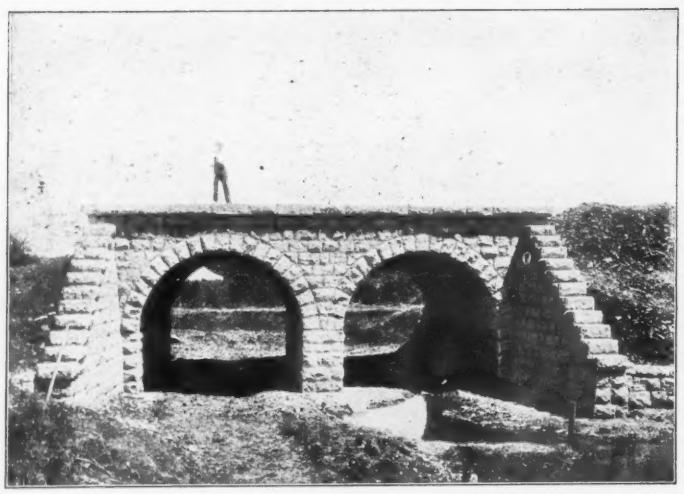
Newkirk is located on a high table land underlaid with limestone, and the water obtained from wells is too hard for boiler use and too small in quantity to supply a steam pumping plant. For these reasons the Chief Engineer decided to build a reservoir for engine water, at a place 2½ miles from town, by raising the grade line of the embankment to form a dam, thus impounding in a ravine about 93,000,000 gal. of water. The drainage area of this reservoir is 2.45 sq. miles, and the project made it necessary to excavate a new channel for Wolf Creek, 2,800 ft. long, and parallel to the railroad embankment. This creek has a discharge of about 2 cu. ft. per second for about six months in the year. The location of the high-water line made it necessary to buy outright two farms and a portion of a third, as well as change the county road. The railroad company made 7,145 cu. yds. of embankment and built a new 56-ft. pile trestle to raise the wagon road 4 ft. above the crest of the spillway.

In building the embankment for the dam the sod was first stripped from the base and laid close to the slope stakes at the back. A core-trench 6 ft. wide and from 2 to 4 ft. deep was then dug, so as to reach the hard, impervious clay. The embankment was put in by a steam-grader outfit, with which a wheeler outfit worked, borrowing yellow clay for the core in the center. This clay core was solidified by being trampled by men and horses and rolled continually by the wheels of the scrapers and wagons, and was carried up to the water level. The dam has a top width of 20 ft., a slope of 1½ to 1 on the water side and of 1½ to 1 on the back. It contains, approximately, 70,000 cu. yds. of earth. The rip-rap was composed of limestone, hauled by the construction train from a rock-cut two miles away. It was 18 in. thick, and was placed on the face by hand. The dam is perfectly water-tight, there being no seepage either through it or along the base.

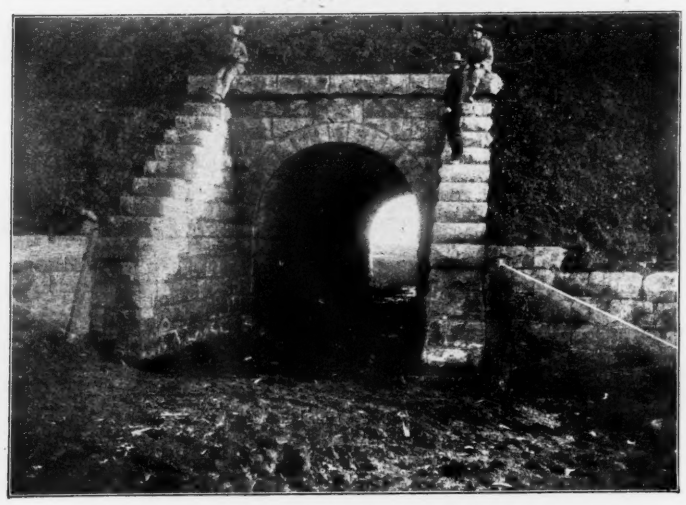
The length of the spillway is 120 ft., the depth of water on the crest being calculated never to exceed 2½

Excavating for Reservoir Spillway.

Double 4 x 3-Foot Box Culvert.



Double 14 x 5½-Foot Arch Culvert.



Typical 10 x 6½-Foot Arch Culvert.

ft. The length of the floor is 100 ft., and the water is discharged into a channel 20 ft. wide on the bottom and having slopes of 1 to 1, the floor being curved to keep the main current on the center line.

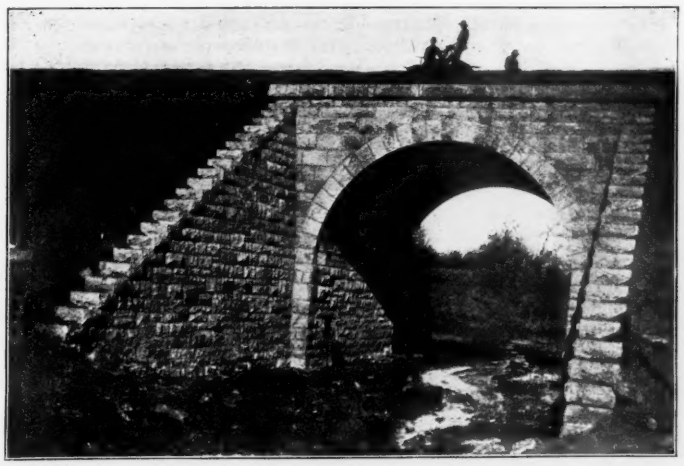
The construction was commenced in December, and the concreting in January. The curved sides and floor were excavated in the hard red clay on which the spillway is located, the work being done to a depth of 12 in. below the grade stakes set for the top of the pavement. Ogee curve-forms were set for the crest wall, no trouble being caused by their moving during the progress of the work.

The concrete was made in the proportion of 1 part Portland cement, 2½ parts sand, and 4 parts crushed stone, the sand and cement being first shoveled together dry. Some difficulty was caused by the sand being partly frozen, which made it necessary to heat about one-third of the quantity used. The cost of cement, at the factory, was about $1.30 per bbl., and 576 bbls. were used. The cost of the spillway was:

Excavation, 2,178 cu. yds.—Force account		$1,248.33
Stone	$147.20	
Sand	77.54	
Royalty on stone quarried	15.00	
Labor	985.43	
Hardware	7.70	
Carpenter making forms	13.50	
Lumber for forms and sheeting	118.60	
Blasting powder and fuse for quarrying	7.50	
Grading and filling in around walls	58.98	
		1,431.45
Total cost of excavating, grading and concreting		$2,679.78

To this should be added the cost of the cement, say $750, thus making the total cost of the work $3,429.78.

Credit is due the contractor, Mr. L. W. Lewis, of Emporia, Kan., and Mr. E. E. Lewis, his general foreman, for the successful handling of the work and the faithful way in which the specifications were followed. The writer also wishes to acknowledge his thanks to his Assistant Engineer, Mr. H. S. Hancock, Jr., for his accurate instrument work and his unremitting attention to details.



Completed 24 x 10-Foot Arch Culvert.

24 x 10-Foot Arch During Construction.

Water Glasses for Locomotives.

BY J. V. N. CHENEY.

Much has been said and written on the above subject and it does not appear to be definitely settled, as yet, whether water glasses are a success or failure. One writer says they haven't proved a success as they fail to close automatically when breakage of the glass occurs. Another says they do not show the true water level, while another says they do show it more accurately than the gage-cocks on engines using a certain kind of water. Another writer dwells on the dangers from breaking glasses, and so it goes.

To begin with, gage glasses are put on the locomotive for a specific purpose, and are just as essential for the purpose intended as are the driving wheels and connections for theirs. Granting this, they should receive as good care to keep them in condition to perform their office. By this I mean they should be kept tight. Nothing looks more slovenly than gage-glass mountings covered with scale and dirt from leaking glasses. They should be kept clean, which will be easy if they are kept tight; and the latter will be easy if proper care is used in setting mountings in line, and using the proper washers.

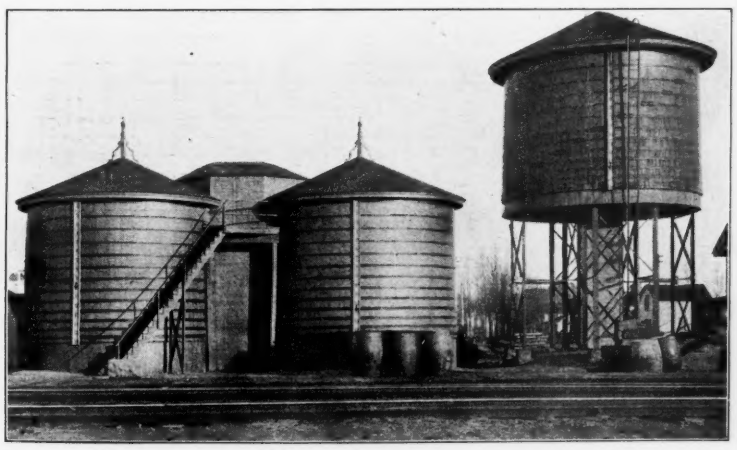
Personally, I like water glasses, having run engines with no gage-cocks, engines with both glasses and gage-cocks, and with gage-cocks alone. I always found time or took time, no matter if it wasn't *my* engine, to take care of the glasses and connections, and always felt repaid for having done so. To be sure, some mountings are very poorly designed, or made, the ordinary run of them having a very poor blow-out cock, generally too small. They soon begin to leak and the engineman, having gotten them closed tight, will not open them to blow out the glass and connections, fearing he will be unable to get them tight again. Soon the connections become clogged, and in the case of automatic closing connections, inoperative. Then the next man tries to blow them out, and fails to get them closed tightly, they have remained closed so long. I chanced to board an engine one day and found my brother engineman vainly trying to close the glass connections, the glass having blown out; but all to no purpose. The automatic feature first refused to close, telling too plainly a story of neglect, and the hand valves were so badly corroded that they would not close tight. It was the standard connection of the road and when taken care of was all right.

A prominent eastern road had engines equipped with glasses; after a time they began to take them off. Why? Because they found, on shopping some engines, that the connections were completely stopped up. Instead of taking off the slovenly engineman, they take off the glasses as being a failure.

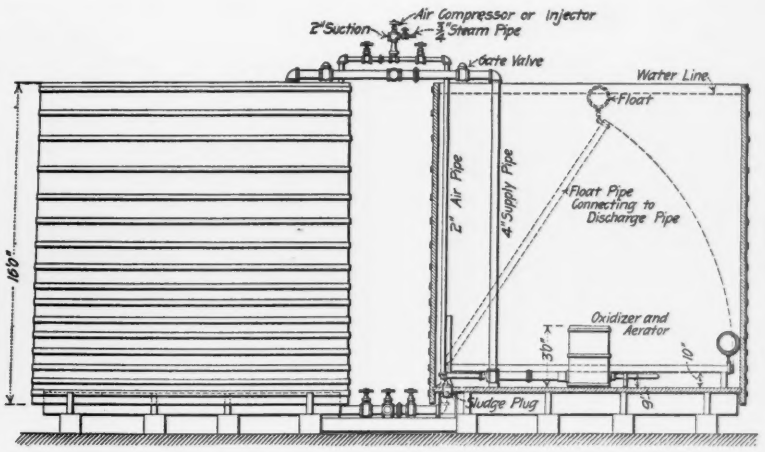
One writer says that you can usually tell by looking at a glass when it should be taken out, the serrations or corrosions at the top being an evidence that its remaining life is short. The same writer says that by introducing a copper pipe into the top of the upper connection the glasses will last longer. This is a new one on me. Possibly there is something in it, but I consider that I get out of it more easily and economically. I am using with moderate pressures a glass-preserving washer, so called, and I find it to be such, as glasses will last for months. There is no eating away of the glass at the top end as is the case with the ordinary washer. These washers are to be had at any supply house. I have found, on taking water-column connections apart, some of the pipes so nearly filled with scale that a fine wire could hardly be passed through them. Imagine the accuracy of the water level shown by this connection.

As to the danger from bursting of glasses, there need be none, as I have used a cage for water glasses that formed a part of the connections, being of ¾-in. iron pipe with slots cut in it longitudinally. This cage is a success. I have used it with 180 lbs. pressure, and have never known of a personal injury from one bursting. The feature of this cage is that a sloven cannot put in a new glass and leave the cage out. He might do that with the lubricator, but with this glass-cage it is impossible.

In conclusion I have but to say, take care of your glasses and connections, and they will be found a useful and reliable part of the engine.



Tweeddale Purifying Plant on the C., St. P. M. & O.



The Tweeddale Water Softening and Purifying System.

The Tweeddale water softening and purifying system consists of two wooden tanks, the water in one undergoing treatment and sedimentation while the treated water is being used from the other. The system is, hence, intermittent, it being claimed that water must be at complete rest for two hours to insure complete precipitation of suspended matter. More uniform results are also obtained and the danger of interruption from freezing or accident is decreased. No pumps or machinery are required and the attendant need only introduce the chemicals and start the ærating jets once every six hours. The raw water passes through a pipe to the bottom of the tank and passes into a chamber filled with coke and iron. From here it passes into the tank through four radial pipes with curved ends. When the tank is nearly filled, air at about 45 lbs. pressure is forced through the chamber, escaping through the radial arms and through a ¼-in. hole on the top. The air may be forced in by a ⅛-in. steam jet. This violently agitates the water. The oxygen of the air, it is claimed, removes organic and volatile matter, and causes a mechanical separation of the solids in the water. In about five minutes a predetermined quantity of a standardized chemical reagent is poured in, and the agitation continued for 15 minutes. A coagulant is then added, and sedimentation is allowed to take place for one or two hours.

The sludge is washed out occasionally, after being allowed to accumulate until it is 5 or 6 in. deep. It is

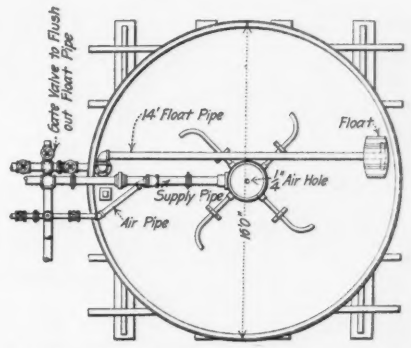


Diagram Showing Principle of the Tweeddale Water Purifying System.

claimed that the stirring up of this sludge aids sedimentation. The treated water is drawn off at the top by means of a swinging pipe fitted with a float. For railroad water stations, only a single treating tank is required, this being placed above the ordinary tank. After treatment the water passes down through a pipe in a frost proof casing and up through another pipe into the tank, the treating tank being again filled with the raw water. The accompanying photograph shows a plant with two treating tanks built for the C., St. P., M. & O., where four are in use. The diagram shows the general arrangement of the system.

There are 28 Tweeddale plants now in use, seven of which are on railroads. On the Chicago, St. Paul, Minneapolis & Omaha its use has effected a saving in expenses for fuel and repairs to boilers. The Boston & Denver Consolidated Mining & Milling Co., at Black Hawk, Colo., has had its fuel bill reduced by $600 per month, and its pipes, which were formerly eaten out rapidly by the acid water, now give no trouble. The Union Ice Co., at Los Angeles, Cal., has found a saving in fuel, repairs and cost of water amounting to $469 per month. The Tweeddale process enables water from the wells to be used. The plant at the power house of the Edison Illuminating Co., of Topeka, Kan., has been in operation for four years, supplying Babcock & Wilcox water-tube boilers. When first put in service, the boiler tubes had ¼ to ½-in. of scale. For the first few weeks, the boilers were blown off once or twice a day, to remove the old scale which became dislodged from the tubes and shells. After this no new scale formed. A new boiler was put in operation Nov. 2, 1899, and had not been washed out up to June 25, 1900, at which time an examination showed that the tubes were perfectly clean. The system has saved about $125 a month in fuel and repairs. At this plant the water is treated with a solution of hydrate of soda, and chloride of iron is the coagulant. An analysis of the water, before and after treatment, is given below:

	Grains per gallon. Before.	After.
Carbonate of lime	17.20	2.23
Carbonate of magnesia	10.05	1.45
Sulphate of lime	15.26	0.00
Sulphate of magnesia	0.00	0.51
Sulphate of iron	0.56	0.00
Silica	4.42	0.61
Oxide of iron	0.00	0.09
Organic matter	3.03	0.00
Alkali solids	20.33	21.51
Total solids	70.85	26.40
Total incrusting solids	50.52	4.89

The apparatus is handled by the Tweeddale Water Softening Company, Fisher Building, Chicago, and we are indebted to the president, Mr. C. S. Burt, for the illustrations and details of the above description.

Experiments with Stacks and Exhaust Pipes.*

There are no parts of the locomotive about which so little is definitely known as the stack and exhaust pipe. The standard practice on most roads has been empirically derived from the construction that has given the best service. The stack and exhaust pipe are the only factors to be considered, as the diaphragm is only used to distribute properly the draft between the top and bottom flues, and must be adjusted in service. The netting is also a secondary consideration, as it can be arranged in any way to suit the fancy; provided, there is sufficient opening for the free passage of gases. It is the vacuum and large nozzle we are after, and vacuum factors only are considered, viz.: the stack and exhaust pipe. The volume of the smoke-box may, and probably does, affect the vacuum to some extent; how much, can only be determined by experiment in a more exhaustive test than this.

The results of the experiments to which this article refers are radical and far-reaching, and it is thought they will be of general interest. They are based on the assumption that if a locomotive were built to a quarter scale, the best arrangement of stack and exhaust pipe for producing a maximum vacuum would be as effective as on a full-size engine. This assumption may or may not be accepted, and the absence of any positive information as to exactly how the vacuum is produced, makes it impossible to offer any mathematical proof of the proposition.

The tests at Purdue University show that "the jet acts upon the smoke-box gases in two ways: First, by frictional contact it induces motion in them; and second, it enfolds and entrains them." The velocity of the jet is the same for equal exhaust pressures, regardless of the size of orifice, and in the present tests we have a jet of steam of the same density and velocity as in the full-size engine. As a vacuum is produced by the frictional contact of the outside of the jet with the smoke-box gases, and also by entrainment, we would expect in the test, where the velocity and density of the jet is the same, and where the entire apparatus bears the same proportion to the steam jet as exists in the full-size engine, that the vacuum produced would be proportional to the amount of outside surface of the steam jet exposed to the gases in the smoke-box. We would therefore expect the vacuums produced in the test apparatus to be one-fourth of those obtained in the locomotive. A proof of the correctness of this assumption is given later.

Taking as a basis for test a 19-in. x 24-in. locomotive, with 62-in. driving wheels, the apparatus shown in Fig. 1 was constructed. Steam passes from a boiler through a reducing valve into a drum, where any desired pressure can be maintained with absolute accuracy. The steam passes then into an apparatus designed to produce an intermittent exhaust or constant flow of steam as desired, and which can be run at any desired speed by cone pulleys from a countershaft overhead running at constant speed. The cylinder of this machine has a volume equal to $^1/_{64}$th of the volume of a 19-in. x 24-in. cylinder at the moment of exhaust opening, when running at a speed of 35 m.p.h. (dependent on the movement of the slide valve). The exhaust pressure is noted by an indicator placed in the end of this apparatus. The exhaust from this cylinder passes through a rubber hose to the exhaust nozzle, which can be raised or lowered as desired by a lever. The distance of the nozzle from the base of the stack is noted by a scale. The smoke-box has a volume $^1/_{64}$th that of the regular engine, and the stack is reduced to the quarter scale. A vacuum gage is so arranged that one side of the U tube is enlarged into a basin, so that readings can be taken with greater accuracy on one side of the tube. The vacuums given are not perfectly accurate, as no account is taken of the fall of water in the basin, but they are entirely comparable, as the fall in the basin is always proportional to the rise in the tube, and only amounts to 1-100 in. to 1 in. rise in the tube. Opposite the vacuum gage is a slide by which the air inlet can be varied at will.

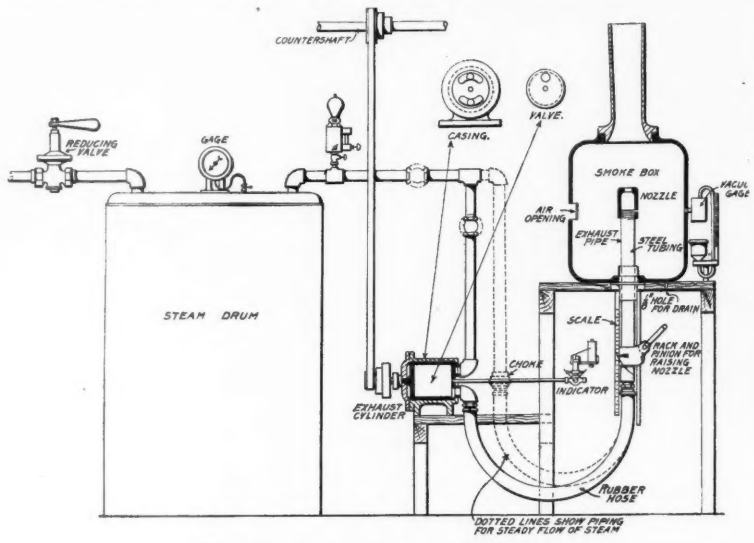


Fig. 1.—Quarter-Size Test Apparatus.

To prove the correctness of the original assumption, that the quarter-scale apparatus represents the conditions in a locomotive, the following test was made: Referring to the report of Mr. Quayle's committee (Master Mechanics' Proceedings, 1896, p. 87), it will be noted that a vacuum of 3 in. is obtained with a 14-in. choke stack, and 4¾-in. nozzle set at 29 in. from the base of the stack, engine running at 188 r.p.m., with an exhaust pressure of 32½ lbs. (scaled from the indicator card shown on plate 49, p. 142), and with an air opening through the grates of 185 sq. in. A vacuum of ¾ in. was obtained with the test apparatus with the conditions of nozzle and stack identical, except reduced to ¼ scale. The speed was 750 r.p.m., equivalent to 188 r.p.m. of the engine, as there are four exhausts per revolution. The exhaust pressure was held in the exhausting cylinder at exactly 32½ lbs. (shown by the indicator). The air opening in the smoke-box was 10 sq. in., which is $^1/_{16}$th of 160 sq. in.; it being assumed that 160 sq. in. direct opening into the side of the smoke-box would be equivalent to 185 sq. in. at the grates, on account of the friction around the arch, in the flues, and around the diaphragm in the engine on the North Western testing plant. The vacuums shown on this curve are absolute, as corrections to be made for the fall of water in the basin of the vacuum gage are too small to take account of. This vacuum of ¾ in. multiplied by four gives the identical vacuum obtained in the North Western test, and leads to the belief that results obtained on the quarter-scale test apparatus can be applied to locomotives.

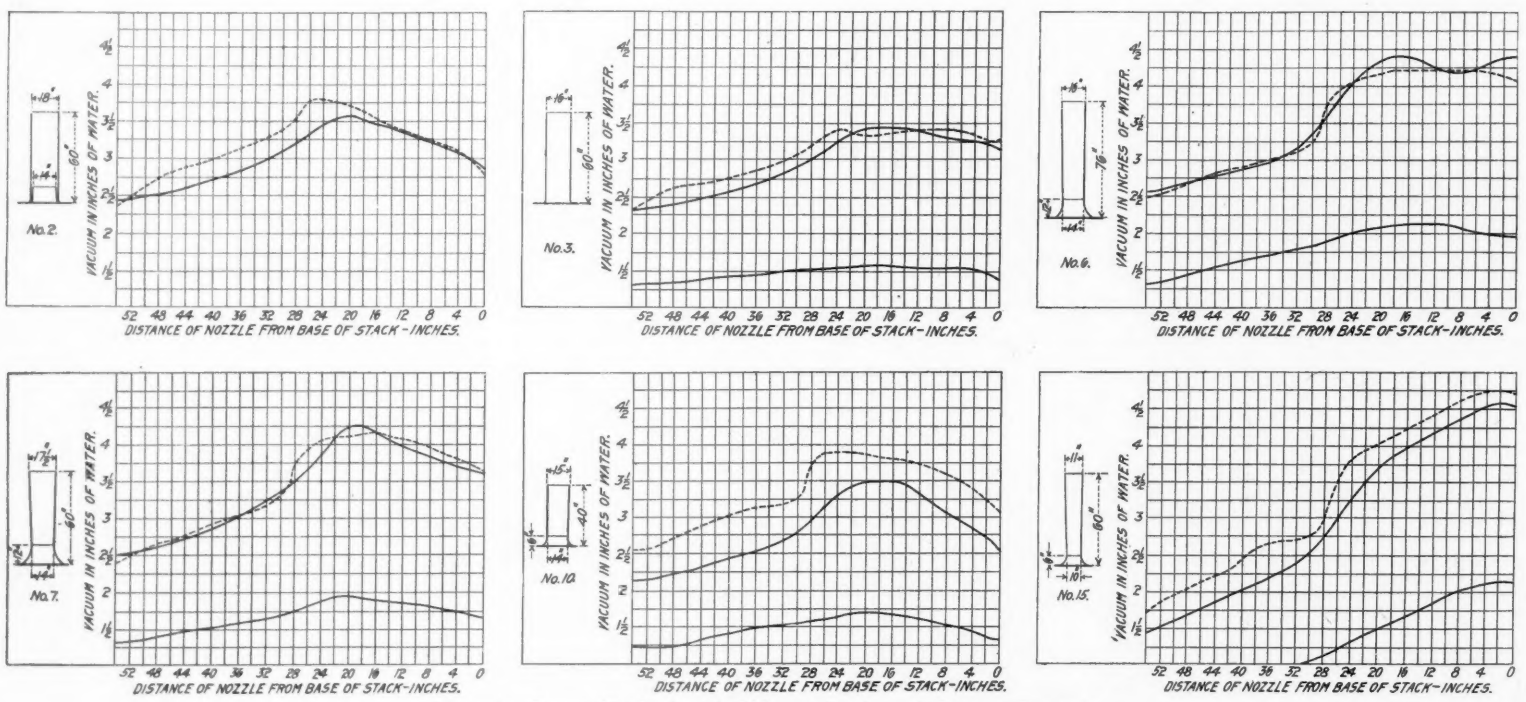


Plate A.—Curves Obtained with Different Stacks and Exhaust Pressures.

Another assumption is made for the purpose of proving that the results obtained on the test apparatus are similar to those obtained on the locomotive, viz., that similar vacuum curves are produced by an intermittent or a steady flow of steam, where the volume of steam exhausted is the same and all other conditions identical. This was clearly shown in the Master Mechanics' report of 1896, and the similarity of these curves is also shown in Plate A, where the orifice for the steady flow of steam was figured to give the same steam weight as in

*Extracts from a paper presented at the October meeting of the Richmond Railroad Club by T. H. Symington.

the intermittent exhaust by the Roentgen-Dubois method.

The vacuum will increase as the air inlet in the smoke-box is decreased. The vacuum curves obtained with 10 sq. in. of air opening are similar in form to those obtained with 2 or 3 sq. in. opening, except that the difference between the maximum and the minimum vacuum is much greater with the smaller air opening. For this reason, all comparative tests were made with a small air opening, as by this means we have a more sensitive apparatus.

As steaming conditions are usually poorest on level roads where trains are run at high speed, the majority of the tests were made at a speed of the apparatus of 985 r.p.m., equivalent to 246 in the locomotive, or about 45 m.p.h. Some tests were also made at 750 r.p.m., equivalent to about 35 m.p.h. In all references to the stacks and nozzles, and to the distances from the nozzle to the base of the stack, the equivalent dimensions of the full-size locomotive will be given. The equivalent of a 5-in. nozzle is used throughout the tests.

Plate A shows vacuum curves produced with various stacks with exhaust pressures of 60 and 30 lbs., respectively, and also with a steady flow of steam.*

Plate B shows some special tests made. Fig. 1 compares a large stack and small nozzle with a small stack and large nozzle Fig. 2 shows vacuums produced with three different shaped nozzles—X, Y and Z. Fig. 3 shows variations in vacuum, due to different exhaust pressures Fig. 4 shows variations in vacuum, due to different air inlets in smoke-box.

Referring to Plate A attention is directed to a few important deductions that can be made.

1. The smaller the stack, the closer the nozzle must be to the base of the stack for maximum efficiency.

2. The distance from the nozzle to the base of the stack for maximum efficiency is about the same, whether with a steam pressure of 60 lbs., or of 30 lbs.

3. The character of the curve produced by a steady flow of steam is about the same as the curve produced by an intermittent exhaust.

4. A straight stack can be greatly improved by placing a small cast-iron choke in the bottom (No. 2). [The maximum vacuum without the choke was $3^1/_{32}$ in.—Editor.]

5. The Master Mechanics' recommended stack, No. 7, with 14-in. choke, gives a larger maximum vacuum than any other stack with a 14-in. choke of the same length.

6. The much-tapered stack, No. 7, must have the nozzle set more exactly for maximum vacuum than the straighter stacks.

7. The reversed curves in Nos. 5, 6, 11 and 12 represent, I believe, the entraining and the frictional action of the steam jet. As the nozzle is raised the vacuum increases until a maximum of entraining effect is obtained with these stacks, and further raising of the nozzle reduces the entraining action; still further raising increases the vacuum, due to frictional contact of the jet of steam.

It cannot be inferred from the vacuums given for different stacks that the very small stacks will be efficient on any engine, but only under the conditions noted, with very small air inlet in the smoke-box.

Referring to Plate B, it will be noted that under the conditions in the test of Fig. 1 equal vacuum is obtained with a 5¼-in. nozzle in stack No. 11 as with a 4½-in. nozzle in stack No. 2. Fig. 2 shows that nozzle Y is more efficient than either X or Z.

The results obtained in these tests have led me to believe that results obtained on any type of locomotive cannot be duplicated on another locomotive of different design and in different service. There is certainly some one arrangement of stack and nozzle that will give a maximum vacuum with a maximum nozzle on any engine with particular reference to that engine's exhaust pressure, volume of cylinder, and rapidity of exhaust.

Previous experiments give us little information for the roundhouse man as to how to fix a poor-steaming engine, or information that will enable the mechanical department to decide on the best construction for any one type of locomotive. It is impracticable to get any accurate results while the engine is in service on account of the great number of variables, and it is also impossible to make proper adjustments and observations with the fire-box full of hot coal and the front-end full of hot gases.

1. Place the engine that is not steaming properly in a convenient location and draw all the water from the boiler.

2. Cover the grates to the usual depth of fire with broken-up coal to give about the same air resistance that obtains in service.

3. Close the throttle tight and remove both slide valves from the steam chests.

4. Connect the empty boiler with the dome of an adjacent engine by a pipe through the whistle openings in the dome or at some other convenient point, and place a valve in the pipe so that steam pressure can be held constant in the empty boiler.

5. Connect the empty boiler by a pipe with one steam chest, running the pipe between the check-valve opening of the boiler and the relief-valve opening in one steam chest, so that steam can be drawn from the boiler direct to the steam chest and regulated by the use of a valve.

The most accurate way to get service conditions is first to indicate the engine to be tested and scale the cylinder pressure at the moment of exhaust opening under normal conditions; also figure out approximately the steam weight passing through the nozzle of the engine under normal conditions in a given interval of time. It is a simple matter, then, to hold the steam pressure in the empty boiler during the stationary test the same as the exhaust pressure in regular service. The diameter of a choke in the pipe between the empty boiler and the steam chest of the engine in stationary test to allow the given weight of steam per minute to pass up through the exhaust pipe, can be quickly and accurately figured by the Roentgen-Dubois method.

The method for getting a vacuum in test engine is to hold the steam in the empty boiler at the predetermined ordinary exhaust pressure which can be easily done by the valve in the inlet pipe connecting the empty boiler with the boiler of another locomotive or with a stationary boiler.

The vacuum readings should be taken in the smoke-box behind the diaphragm, and any combination of stack, exhaust pipe, or nozzle can be tested and the vacuums obtained compared, with full assurance that the arrangement that gives the maximum vacuum with the maximum exhaust nozzle in this test will give the same results in service. The vacuum gage described in this paper should be used, as comparative readings can be more accurately made than with an ordinary U tube.

Where it is found necessary to adjust the diaphragm to burn the fire uniformly, accurate vacuum readings can be taken in the fire-box by placing the vacuum gage in a wooden plug driven into the fire-box end of one of the top row of flues and one of the bottom row of flues. Workmen can get into the fire-box on top of the coal, and also in the front-end of the engine while the test is going on, as the temperature is very much less than the temperature of steam at the pressure in the boiler, due to circulation of air from the outside.

Observations can also be very readily made to determine whether the exhaust jet strikes exactly in the center of the stack, which is imperative for maximum efficiency.

If it is impracticable to indicate the locomotive and determine closely the exhaust pressure and also to determine the steam weight escaping through the exhaust under normal conditions, these factors can be estimated and comparative results will be obtained that can be relied upon to be similar to results obtained in service.

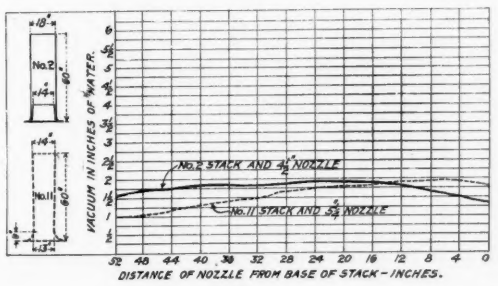

No. 2
No. 11
No. 2 STACK AND 4½" NOZZLE
No. 11 STACK AND 5¼" NOZZLE
VACUUM IN INCHES OF WATER.
DISTANCE OF NOZZLE FROM BASE OF STACK – INCHES.

Fig. 1.

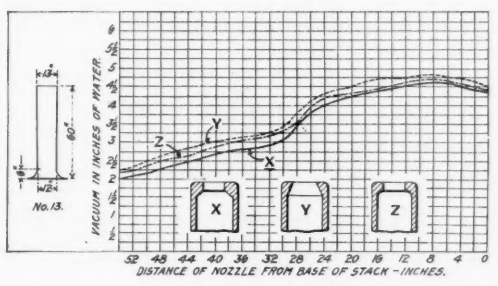


Fig. 2.

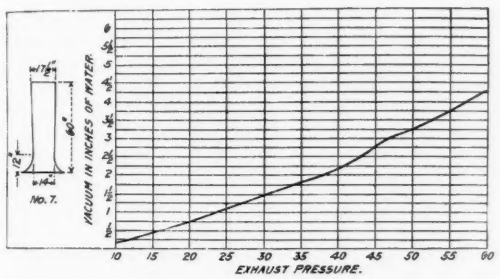


Fig. 3.
(5-in. nozzle set 20 in. from base of stack, 48 sq. in. air inlet, speed 45 m.p.h.)

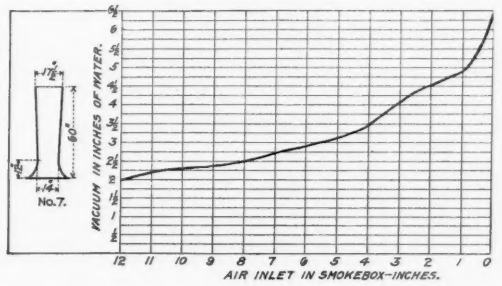


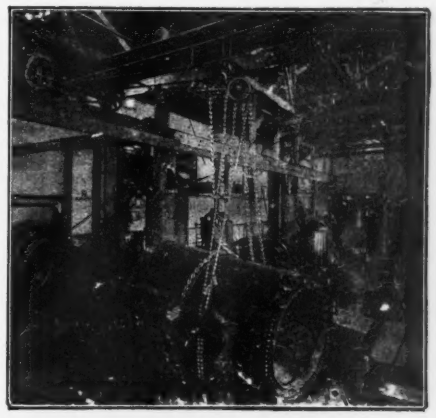
Fig. 4.
(5-in. nozzle set 20 in. from base of stack, 60 lbs. exhaust pressure, speed 45 m.p.h.)

Plate B.—Curves Obtained in Special Tests.

*Only 6 of the 15 figures shown in the paper are reproduced.—Editor.

The Yale & Towne Triplex Block.

In handling heavy materials two kinds of machines are used, viz.: a hoist for vertical movement; and a crane or trolley for horizontal movement. Where the load exceeds the lifting capacity of one or two men the hoist is the essential factor, while the crane or trolley may or may not be necessary. In considering apparatus for transferring material, this fact is sometimes overlooked and the chief attention given to the mechanism for horizontal motion. This is important, but the mechanism for vertical motion is more important.



Raising a Finished Boiler with a Six-Ton Triplex Block.

The engraving shows a simple and compact form of hoist. It is the triplex block, made by the Yale & Towne Manufacturing Company, and claimed to possess a higher mechanical efficiency than any other available machine. It is portable and may be hung by its hook to some overhead support, either fixed or movable; it is also arranged to be built into a trolley intended to travel either on a crane or on an overhead tramway. It may therefore be used as the hoisting device in almost every type of machine for the handling of material. It will lift 20 tons 5 ft. in 10 minutes, and 300 lbs. or less, 30 ft. a minute.

The table below gives the time required for hoisting various loads to a height of 4 ft. with ordinary screw blocks, with Yale & Towne triplex and duplex blocks and with electric hoists. It is assumed that 4 ft. is an average lift, and the table gives the time required per lift and the saving of time compared with the ordinary screw block. While the speed obtained with electric hoists is higher than with the triplex block, the latter is so much faster than ordinary hoists as to effect a very important saving, amounting to two-thirds of that obtained by means of power hoists.

Comparative Speeds of Portable Hoists.

No. of men.		Time in seconds.	Saving in seconds.
	300-lb. Load.		
1	Common screw hoist.....	60	....
	Y. & T. duplex screw hoist.....	48	12
	*Y. & T. triplex block.....	24	36
	Electric hoist	15	45
	2,000-lb. Load.	Time in minutes.	Saving in minutes.
1	Common screw hoist.....	5	....
	Y. & T. duplex screw hoist....	4	1
	Y. & T. triplex block.....	2	3
	Electric hoist	0.35	4.65
	4,000-lb. Load.		
2	Common screw hoist.....	5	....
	Y. & T. duplex screw hoist.....	4	1
	Y. & T. triplex block.....	2	3
	Electric hoist	0.25	4.75
	6,000-lb. Load.		
2	Common screw hoist.....	10	....
	Y. & T. duplex screw hoist....	8	2
	Y. & T. triplex block.....	4	6
	Electric hoist	0.50	9½
	20,000-lb. Load.		
3	Common screw hoist.....	30	....
	Y. & T. duplex screw hoist....	15	15
4	Y. & T. triplex block.....	5	25
	Electric hoist	0.50	29½

*1-ton pattern for quick speed with light loads.

The speeds for hand chain blocks are taken at half the speeds which are obtainable for short lifts with brisk work. The time of hoisting can therefore be easily realized; a further saving can be made where piece work prevails. With 10-ton loads there is a greater difference in speed than in the smaller sizes, because ordinary screw blocks are not sufficiently powerful for lifting such heavy loads without the use of differential gearing which is very slow and inefficient. The 12-ton triplex block is used to obtain the speed given in the table (4 ft. in five minutes) because the 12, 16 and 20-ton sizes have two independent hand chains enabling one, two or four men to work to advantage. Twenty tons can be lifted 4 ft. in 10 minutes by four men with the 20-ton block, and if suspended from a suitable trolley or crane with anti-friction bearings the load can be moved 150 ft. per minute.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The paper of Mr. A. G. Allan, read last week before the American Society of Civil Engineers, and printed almost in full on another page, recalls Mr. W. J. Nicholls' "Railway Builder"; and a comparison of the two shows in a striking way the difference between a dry text book and a live narrative. Mr. Nicholls wrote his book in 1878; and in its revised form it is still a standard reference work. It gave in a few pages the costs by estimate of different kinds of work to be done in the building of a railroad, the surveys, the construction of permanent way, the rolling stock and the equipment. In the preface of the 1897 edition the author says, "Capitalists, . . . contractors, . . . and the host of practical men who operate railroads will find in this book plain and simple directions for estimating the first cost of a railroad, and the young student will find much that has heretofore been covered with many formulas and tedious analyses." Mr. Allan gives a simple and straightforward account of the construction of a new line in Oklahoma 60 miles long through a comparatively level country, presenting no great engineering problems to be solved, but involving only the usual practice in locating and building a line for heavy freight traffic with minimum curves and grades and permanent and substantial roadbed, arches and culverts. The story of his work, for it reads with all the charm of an autobiography, seems almost the antithesis of Mr. Nicholls' cold statement of fact, yet it contains as much information on the first cost of a railroad for the capitalist, the contractor and operating men as the older book; possibly more. The detailed cost of material and labor given in the paper is well worth a careful study. It it not often that figures so much sought after are available. Often no analyzed cost sheet is kept, though the lack of published facts is more often due to the fact that it is not deemed advisable to give out such figures for general circulation.

Trainmen's Eyesight.

The paper by Dr. Allport on trainmen's eyesight, which was printed in our issue of October second, is notable as dealing with the subject in a practical way, from the surgeon's standpoint. In contrast to the utterances of some specialists who have discussed this subject in past years, Dr. Allport recognizes at the outset that the feelings and even the prejudices of old employees must be reckoned with, and that labor unions, blindly fighting for supposed rights, may thwart the efforts of a well-disposed superintendent who knows the necessity of getting rid of men with dangerous eyes but has not the grit (or the support) to carry out his purpose. Surgeons possessing this kind of common sense are the kind needed on a railroad.

But the doctor's present exhortation in this line will be more useful to his professional brethren than to railroad officers. Superintendents and trainmasters are too lenient already. They have an unwelcome variety of incentives to laxness before the surgeon says a word. It is important, therefore, in reading this paper, to keep in mind the fundamental purpose of eye examinations. With no abatement of interest in employees' personal welfare, the judicious superintendent will aim to promote that welfare while still maintaining the highest scientific requirements in everything affecting the safety of trains, passengers and employees.

The author of our paper says that leniency must go as far as is consistent with safety; but how far does that mean? Two principal defects are to be guarded against, color-blindness and shortsightedness. The color-blind trainman who cannot instantly distinguish red from green is absolutely disqualified. The only leniency that is fitting in his case is to give him another kind of work. Dr. Allport speaks of the superior judgment of a man 55 years old. With a color-blind who for years has guessed at signals by the degree of their grayness or by some other circumstance, this would seem to mean that he can guess more successfully than when he was younger; but surely the only safe rule is to tolerate no color-blindness whatever. One might theorize that long experience would lead a color-blind engineman to be more cautious; that, knowing his disability he would reduce the speed of his train rather than take chances. But on the other side is the fact that most color-blinds have pursued a life-long course of deception. They have tried to convince themselves that they are just as competent as normal-eyed persons, and, consciously or unconsciously, have aimed to convey the same impression to other people.

It is true that in the past the guessers have had great success; but the value of color-sense testing is in the safeguard thus provided against those occasions when guessing will not answer; when the color, and that only, tells the engineman whether to stop or to proceed. Color-blindness being usually congenital and always incurable, this part of the problem is fortunately uncomplicated by conjectures as to future changes in the employee's condition; and it should be free from disputes as to the responsibility for the past. The color-blind knows his condition, and in attempting duties beyond his power he has acted with his moral eyes open, whatever may be said about the physical orbs; he is not relieved from responsibility by the fact that the railroad company was so ignorant as to employ him.

Inability to see signals at a distance, regardless of color, is a different question. Here it is not so easy to draw a precise line between safe and unsafe eyes, but the duty of drawing the line somewhere is just as imperative. Leniency based on the veteran's supposed ability to act with better judgment, in spite of defective eyes, than a less experienced man would when his eyes served him well, is a dangerous kindness. Occasions are too likely to arise when the lookout man needs both good judgment and good eyes. And as long as conductors and other men are employed as pilots when need occurs, it is important to avoid the error of thinking that strict application of eyesight-rules is necessary only with enginemen. Dr. Allport commends the surgeon who does not split hairs unnecessarily; but the surgeon will do well to give an unqualified final verdict rather than to leave a delicate decision to be made by a superintendent who shrinks from taking a favorite runner off from a fast train.

Of all the different kinds of leniency, that which is due to fear of the brotherhood is the most deplorable. This is a particularly insidious danger, for although the demand made by the Grievance Committee is rooted wholly in the fear of losing pay and, like the recent demand for double pay on double headers, does not even pretend to be supported by reason or science, it is exactly in line with the personal feeling of the superintendent toward experienced enginemen who have given satisfactory service and whose eyes are suddenly discovered to be below par. As the superintendent has a good motive himself, and tries to believe there is some way to get around the inexorable requirements of the oculist, he is liable to try to impute right motives to the grievance committee, forgetting that these men make it their business to secure the retention in the service of every member of their union.

The wise course for the superintendent, in dealing with a faithful and efficient employee whose eyes fail, is to pay him as much as can be afforded, while keeping him entirely out of work in which defective eyesight is in the least dangerous. We do not pretend to be showing the superintendent a new course. This plan is the obvious one. But it is not so obvious that it is good business. It is often called philanthropy. But, surely, when a railroad has employment for a hundred different kinds of talent, it is not obliged to turn off an employee who is intelligent enough to have earned from $75 to $150 a month for a term of years.

It takes time and thought to find a satisfactory and reasonably well-paid job for an employee 50 years old who must leave the train service, but determined effort to find it should be as profitable as efforts in other directions for the amelioration of employees' social or domestic circumstances. To put an intelligent conductor to flagging a crossing at $1.50 a day because he has lost a leg or has become color-blind from using tobacco may be, from a cold legal standpoint, as good treatment as he is entitled to; but how about the transaction from the company's standpoint? Perhaps a corporation cannot look at any transaction in any way but the cold and legal one; but even so it gains much good-will by favoring disabled employees; and good-will has a money value. A "campaign of education" should be kept up wherever ignorance exists. Brotherhoods fight vision tests partly because they do not realize what a rational process the test is. To postpone a test to give the men time to enlighten themselves does not produce results soon enough. Knowledge should be spread by the men who are best informed, and it should be done systematically.

The Business Situation.

This country has been passing through a period of extraordinary prosperity. Nearly all industries have for some years had such demands for their products that their capacity for production has been increased, in many branches immensely. The traffic statistics of the railroads which we have published recently prove this sufficiently, if it needed any proof. An increase of 65 per cent. in freight traffic in the five years from 1897 to 1902 means an increase in production. As it is not possible for agricultural production to grow so fast (the imperfect statistics indicate a growth of less than 30 per cent. in that time), it means an increase in industrial production at even a greater rate. And as the railroad gross earnings so far in the current year have increased more than in any of the five years previous, even, it is evident that this increase of production continued during the year following that last reported (to June 30, 1902).

But in the face of this marvellous growth of production and traffic, the shares of nearly all railroad companies, and still more of industrial companies, have been falling for more than a year; and the prices of the product of the greatest of the foundation industries, the blast furnaces, have fallen so much that recently they have greatly reduced their output.

Under these circumstances the community is wondering whether we are approaching the end of our extraordinary prosperity, and whether it may not close with a crash, as in 1873 and in 1893, or a marked depression and stagnancy, as about 1884. We dare not assume to satisfy this curiosity, but we may call attention to some facts in the present situation, and in the past economic history of the country, which may help to explain the situation.

In the first place, there can be no doubt that industries have been expanded at an unprecedented rate since 1897, and that usually in periods of great prosperity there is some, often a great, over-expansion in certain directions. Nor is the fact that there has been a demand for all that is produced proof that there is no over-expansion. In times like these, a large part of the production of many industries goes to provide facilities for the further increase of production. When buildings were put up in Chicago before the World's Fair at a rate two or three times as great as even its rapid increase of population, there was for some years afterwards a greatly reduced demand for building materials, masons and carpenters. Striking instances in this country have followed periods of excessive railroad construction, as before 1874 and 1884. When the new mileage, which for the three years to the middle of 1883 had been 29,127 miles, fell to 14,609 in the next three years, somebody had to suffer. The provisions for doing such work had been increasing constantly during the years of much building, and would not have been fully occupied even if the rate had been kept up.

In 1873 and 1884 the bad times were very largely

the result of excessive railroad building. In one year we increased our great mileage no less than 11 per cent., with an increase of population of perhaps 2½ per cent. But this was not the case in 1893, and it certainly is not now. However it may be with electric railroads, the increase in steam railroads has been of a more moderate rate than in any other period of prosperity. The average new mileage, which was 9,709 miles per year in the three years to the middle of 1883, 8,209 for the four years to 1890, was but 4,392 miles for the three years to 1902. The larger construction in the following year, not yet reported, may bring up the construction of the last four years to 5,000 miles per year, which is an increase of less than 2½ per cent. a year; and the construction for the eight years to 1902 (26,010 miles) is less than for the four years to 1890, or the three to 1883. An enormous increase in the capacity of old lines has been made since 1897, but that was required by the increase of 65 per cent. in traffic meanwhile; and generally, it may be said, there is little to be feared from the expansions of established railroad companies; they have the best existing information of the requirements of traffic, and they, themselves, are the sufferers from unwarranted extensions. Their recent great prosperity is due largely to the small increase in mileage. Gross earnings per mile increased from $6,132 in 1897 to $8,625 in 1902, which could not have happened with so great an increase in mileage as in other prosperous periods; still less the increase from $2,016 to $3,048 in net earnings per mile in the same period.

In the earlier years of the *Railroad Gazette*, the prosperity of the country was determined mainly by its agriculture; but agriculture is not now so overwhelmingly important, other industries having grown much faster, and some of them affording a considerable surplus for export. Heretofore, the expansion of the area cultivated has been greater in dull than in prosperous times, and this has probably been the case recently. A great expansion of industry employs men who otherwise would become farmers. But the agricultural population has been prosperous of late years, and has fairly good crops this year and fair prices. Any depression that may occur will not begin with it this year. But this was true also in 1873, when crops were exceptionally great, prices for them exceptionally high, and the foreign demand exceptionally great. This certainly alleviated the situation, but it did not prevent disaster.

It is not possible to measure precisely the growth and production of manufactures, but we have returns from what is now doubtless the leading foundation industry, iron production. That may be said to be the creation, almost, of recent years, and its growth has been one of the marvels of industrial history. In 1866, the first year after the war, this country produced about 1,000,000 tons of pig iron; in 1872, and also in 1873, 2,300,000 tons; falling to 1,600,000 in 1876, and rising to 4,400,000 in 1882. A fall to 4,045,000 in 1885 was followed by an expansion, which, with a temporary setback after 1893, has increased since at a wonderful rate, from 8,623,000 tons in 1896 to 17,821,000 in 1902. But even this was not the culmination, for in the first half of 1903 the production was 9,707,367 tons, which was 10 per cent. more than in the corresponding half of last year, and more than was ever produced in a whole year previous to 1898. And this enormous production was not sufficient to meet the demand; for in this half-year, importations, which had been insignificant for ten years previously, reached 452,451, making an available supply of 10,159,818 tons, and an increase of 24 per cent. in two years. An industry in which the production has more than doubled in six years, and which even then has not been able to keep up with the domestic consumption, naturally cannot keep on forever growing at that rate. We used at the rate of 512 pounds of pig iron per inhabitant per year in the first half of this year, against 270 so recently as 1897. Now, without declaring that a consumption of 500 pounds per year is excessive and abnormal, and cannot be maintained (though in no country and in no time, heretofore, has there been anything equal to it), we are safe in saying that an *increase* in consumption at that rate, 89 per cent. in six years, cannot be maintained permanently, and that we shall not use 38,000,000 tons of pig iron in this country in 1909. It seems superfluous to argue at such length over such a matter; but the feeling seems to be general that the bare continuance of the present rate of industrial production will be sufficient to maintain the recent degree of prosperity. It will not. The production in this commodity, which requires the extraction and movement of immense quantities of ore, limestone and coal, has been at the rate of more than 12 per cent. per year since 1897. In localities where it is carried on on a large scale, it has pressed the facilities for transportation to an unprecedented extent; the reader will call to mind the condition of things at Pittsburg less than a year ago. Every year it has been necessary to increase such facilities, and they have been increased. Let the production become stationary, simply, without any decline, then the preparations that have been made to handle it—that is, the recent early growth of it—will not be fully occupied. But the history of the industry shows that it is liable to great fluctuations. It not only ceases to grow, but falls off in dull times. It is primarily a material of construction. At the present stage of the world the mere maintenance of the world's equipment of machinery, railroads, buildings, etc., doubtless requires the larger part of the production; but its growth depends chiefly on the expansion of the world's industries, and if anywhere expansion has been excessive for a time, the iron industry, and other industries engaged in producing construction materials, as sawmills, quarries, brickyards, etc., feel it first and feel it most.

The production and consumption of pig iron deserve attention not so much on account of the blast-furnace industry itself, as because pig iron is a raw material for a great many other industries, employing in the aggregate many times as much capital and labor as the blast furnaces themselves. And as a material of construction, it is one of the first industries to feel a slackening in the expansion of many other industries. When there are few new enterprises, inquiries for new materials fall off, while the works furnishing supplies may still be full of unexecuted orders.

How far this is now the case, those engaged in the several industries know best. The actual recent reduction in the output of the blast furnaces is the only very important symptom of it that has become generally known.

If there should follow a cessation for the time or an important relaxation in the growth of industrial production, the railroads should be better prepared for it than in almost any previous period of their history. During the prosperous years most of them have made very important improvements, not all of which, by any means, have been charged to capital. The same is probably true of many industries. The fall in prices of stocks seems to us less significant. When there is a sudden change from stagnation and low prices to activity and high prices, profits are usually extraordinarily great, as the low cost of production of the dull times lasts for some time after the changes. But it is no public misfortune that the profits of a business should be only 10 per cent. in 1903, even if they were 20 per cent. in 1899. And it may be gently hinted that prices on the Stock Exchange may be too high as well as too low. Near the beginning of a period of prosperity many have money to invest outside of their business who never had it before, and when they have seen stocks go up almost uninterruptedly for several months or longer, they compete with each other for a further advance. If those who compare present prices with those of the last two years, and spell ruin, will make their comparisons with those of 1900 and 1899, not to say earlier years, they will get a juster view of the movement of values, though, if they bought in 1901, perhaps not much consolation.

Freight Car Economies.

Not long ago a press despatch from Pittsburg, printed generally in the daily papers, disclosed a state of things decidedly discouraging to those who have hoped that the per diem rule for freight car payments as between railroads would lead to more per diem collections—that is, demurrage—from consignees. Evidently the problem of keeping cars moving and earning money still offers the operating department unlimited opportunities for hard work. The despatch is as follows:

"It is said to-day that 6,000 cars are tied up in the Pittsburg district. The reason given for this is that the consignees fail to unload their cars in the required time. The railroad officers say they have notified them continually that the cars must be unloaded, but they always reply that they cannot get a sufficient number of men to do the work the day they are notified. The next day a hundred cars or so will be unloaded, and that is the end of it until another notice is issued."

The usefulness of this item as history lies in the fact that it shows that the world doesn't move. It was just the same 50 years ago. Railroads notify consignees "continually"; consignees do nothing, and allow cars to accumulate; finally, they unload so many cars at once that their pride in the achievement affords them all needed meat, drink and peace of mind for an indefinite length of time. The establishment of the demurrage bureau 15 years ago and its gradual spread since then has been supposed to be curing this abuse; but it seems that the curative process is still very far from complete. With all praise for what the bureaus have done, they should be pointed to what they might do, if they could keep the traffic department a little more in the background. For example, in Hungary, where the state owns some of the railroads, and exercises over all a more direct control than prevails here, the authorities have lately taken measures to facilitate shipments of grain and flour for export, by shortening free time. As a rule these commodities are to be given the preference over other freights in order of shipment, and the time allowed consignees for unloading all car-load freight is reduced to nine hours.

Or, if foreign practice does not afford a good model to be followed under our conditions, why not introduce a little variety in the methods of money stimulants? A press despatch from New Orleans says that General Superintendent Thornwell Fay, of the Southern Pacific, has offered prizes to the company's agents for the most successful car loading during the coming season. When a heavy shipper complained of scarcity of cars, Mr. Fay found that of the cars supplied to this shipper only 63 per cent. of their capacity had been utilized, leaving 37 per cent. unused space. Mr. Fay's purpose is to give five cash prizes to the agents of the Louisiana lines making the best record in loading cars to capacity between the present time and the end of next June; and he will put in execution a system of checking all cars departing from local stations and arriving at destination, east or westbound. This will stimulate agents to secure efficient loading; but the unloaders need energizing. These are not parallel cases, for a shipper can be induced by argument to put more freight into a car, when all the King's horses could not compel him to come, against his own inclination, and take freight out; but premiums would do good, nevertheless. The storehouse-on-wheels is still a great abuse.

At the annual meeting last week in New Haven of the New York, New Haven & Hartford Railroad a rural stockholder who urged that the title of the company be abridged, brought on a brief but pretty vigorous discussion of a question then, for the first time, raised at a stockholders' meeting of the corporation. On the one hand it was argued that the title was clumsy and outgrown, on the other that it had the dignity of "age," while ex-Governor Bulkley, of Hartford, stated that his city wanted its name retained in the title and would resist a change. The name was adopted thirty-one years ago when the line from New Haven to New York was merged with the line from New Haven to Springfield. The company at that time had about 230 miles of track. It has now under its ownership or control 4,093 single track miles, of which about one-ninth lie between Hartford and New York. It reaches eastward to Cape Cod Point, northward at three points almost to the upper Massachusetts line, westward to Fishkill on the Hudson; owns or controls—except one or two short branches—the whole steam railroad system of Rhode Island, is a through line between New York and Boston, and owns a big steamboat fleet on the Sound. Yet this great system retains a title derived from a mere fragment of the road, and not only that, but a name cumbrous, deceptive and far outlived. Whether the corporation, as was suggested by the late President C. P. Clark, contracts itself to "Southern New England" or not, a verbal shrinkage of some sort will result in considerable final economies in paint bills, ink and pleonasm. And, against it, is set only that narrow "locality idee," more appropriate in politics than in practical railroading. The corporation is a Connecticut one and an act of a few lines passed by the Legislature of that State would reduce the nine words of the legal title to common sense brevity.

New York Central & Hudson River.

In a recent issue of the *Railroad Gazette*, comment was made on the astonishing way in which operating expenses ate up gross earnings on the Pennsylvania Railroad, during the eight months ending with August last, and it was pointed out that nearly 99 per cent. of an increase of $8,893,600 in gross earnings had been thus absorbed. The parallel furnished by the operations of the New York Central for the year ended June 30th is striking. Increase in gross earnings amounted to $6,701,910 and operating expenses increased $6,595,825, which is equivalent to 98⁴/₁₀ per cent. of the gain, as compared with 98⁹/₁₀ per cent. on the Pennsylvania in the period above mentioned. A detailed examination of the causes of increase in expenses shows that conducting transportation increased $3,111,130; the charge for maintenance of way and structures increased $1,869,538, and the charge for maintenance of equipment increased $1,611,412. The largest individual item of increase was repairs and renewals of freight cars, $1,427,305. Repairs of roadway increased slightly over a million, and wages of engine and roundhouse men $537,613. Repairs and renewals of buildings and fixtures increased $566,596, and cost of fuel $442,937. Other large increases were in train service, $398,981; switchmen, flagmen, and watchmen, $394,381, and station service, $281,275. Increases appeared in all of the 53 enumerated items except 11, and the only important decrease in the expense account was in the car service balance. It is not surprising that we hear of retrenchment in shop expenses on the large railroads.

Looking at gross earnings alone the total, $77,605,778, compares with $70,903,868 in 1902 and $66,333,111 in 1901, an imposing showing. Moreover, for the year under review, there was a decrease of $225,509 in passenger earnings, as a natural reaction from the heavy Pan-American traffic of 1902 (autumn of 1901), but it is interesting to see that this passenger decrease was almost offset by the general improvement in passenger traffic; and

a comparison of the passenger earnings with the fiscal year ending in 1901 shows an increase for the year just closed of $2,715,219. Freight earnings were $46,858,713, an increase for the year of $6,198,934. The large decrease in anthracite coal tonnage was more than balanced by the great movement of bituminous coal, which showed the largest increase during the year of any single commodity, 10,398,243 tons having been carried, as against 7,559,748 tons last year. The next largest increase was in grain, of which 2,644,222 tons were carried, an amount 325,427 tons in excess of the grain tonnage last year. Important gains, however, were reported in castings and machinery, bar and sheet metal, cement, brick and lime, ores, fruit and vegetables, and other mill products besides grain. Packing house products and live stock fell off somewhat.

The total outlay for renewal and improvements was $13,267,929, including $1,771,159 charged against the funds provided by lessor companies for work done on leased lines. Over 4¾ millions of the total amount was provided out of earnings. In the last four years, seven millions have been appropriated from surplus to constitute a special improvement fund, of which there now remains a balance of $1,967,920. The work done has been distributed all along the line, and consists of betterments of a permanent and important character. As a statistical curiosity, it may be recorded that there are only 80 odd railroads in the country which can show gross earnings equal in amount to the sum which the New York Central has charged to operating expenses this year for betterments, in addition to a balance of $5,315 a mile for the aggregate of maintenance of way, structures and equipment.

To present these figures in a lump sum, the total charge for maintenance of way, $10,469,570, added to the maintenance of equipment charge of $10,882,375 and the $1,516,954 special fund expenditure, makes an aggregate of $22,868,899, or $6,681 per mile of road, spent on betterment and maintenance, and charged to earnings. Of the three railroads in the country that charged over $20,000,000 against operating expenses for maintenance proper, in their most recent annual showing, the Pennsylvania, of course, is first, with $31,694,007; the New York Central second, with $21,351,945, and the Southern Pacific third, with $21,221,493, but the mileage worked by the last named is so much greater than that either of the Pennsylvania lines directly operated or of the New York Central that the expenditure per mile is not at all proportionate to that of the eastern roads. The following table shows the charge against operating expenses for maintenance of way, structures and equipment, per mile of road, on all railroads in the country on which the annual charge at the last report exceeded $5,000 per mile:

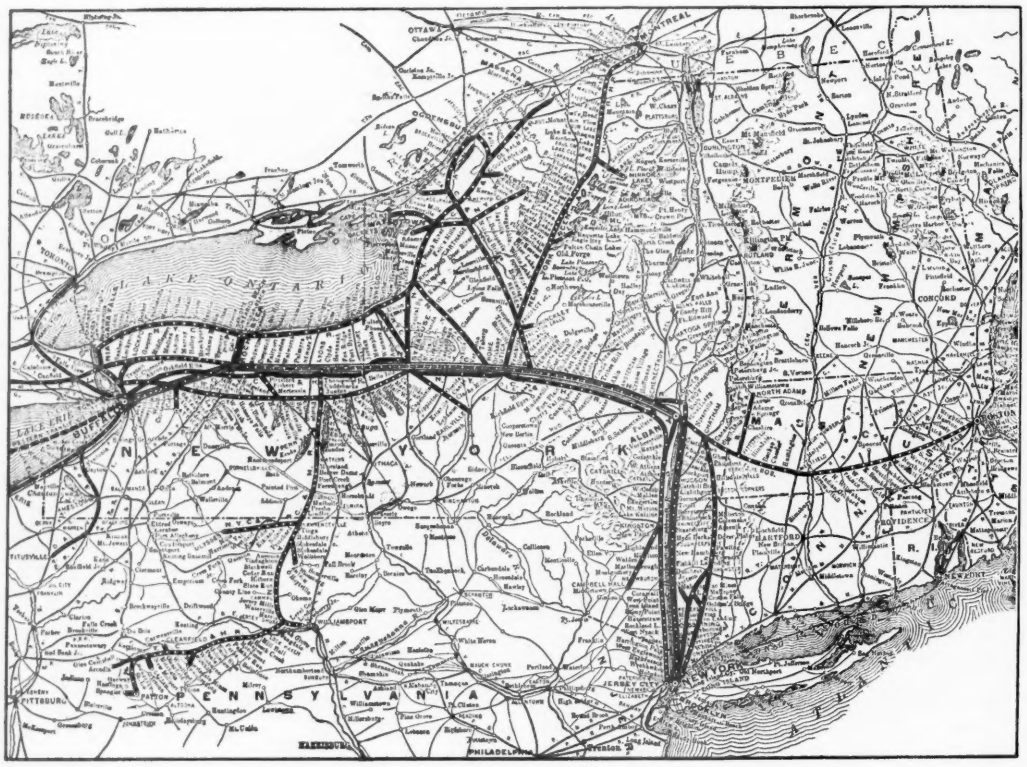
	Mileage directly operated.	Total maintenance charge per mile.
Pennsylvania Railroad	3,706	$8,552
Philadelphia & Reading	1,010	7,842
Pennsylvania Lines West	1,338	7,152
Delaware, Lackawanna & Western	948	6,430
Lehigh Valley	1,392	6,317
New York Central	3,423	6,237
New York, New Haven & Hartford	2,027	5,144

Like the Pennsylvania Lines East, the most striking feature about the New York Central's maintenance expenditure is that it covers considerably over three thousand miles, at the rate of $6,317 a mile.

The Boston & Albany was leased by the New York Central on Nov. 15, 1899. Its earnings for the year ending June 30, 1899, were $9,325,036, and the earnings of the New York Central during the same period were $48,124,016, making a total for the two companies of $57,449,052. The combined earnings of the New York Central and the Boston & Albany in 1900 amounted to $64,519,090, and since then the combined gross earnings have been as follows:

1901..... $66,333,111 1902..... $70,903,868
1903..... $77,605,778

This showing is remarkable not only in the gains themselves, but also in the fact that the increase is greater this year than in any year since 1899, whereas with the majority of the trunk lines a high water mark in gains (though not in gross earnings) was reached last year. The gain in gross in 1903 over 1902 amounts to 9 per cent. The gain in gross in 1903 over 1899 amounts to 35 per cent. This is a showing of splendid prosperity, which does not appear to point to any falling off in the near future.



New York Central & Hudson River.

Capital changes during the year included $337,100 new stock sold, bringing the total issued and outstanding up to $132,250,000, and leaving a balance authorized but not issued of $17,750,000. The funded debt has also been increased $1,200,190 during the year by the issue of 3½ per cent. gold mortgage bonds, and on Jan. 1, 1903, the outstanding first mortgage 7 per cent. bonds of the company amounting to $18,327,000, and its outstanding first mortgage 6 per cent. sterling bonds amounting to $5,724,095 matured, and a like amount of 3½ per cent. gold mortgage bonds of the New York Central & Hudson River Railroad Company was issued in exchange therefor, the latter class of bonds thus becoming the first mortgage upon the property. This will effect an annual saving in interest of $784,000.

The most important new construction work recorded is the opening of the Beech Creek Extension Railroad July 1, 1902, from Keating, Pa., to the main line of the Beech Creek Railroad at Clearfield Junction. The new line has greatly relieved the congestion of traffic on the Beech Creek Railroad and has contributed towards the largely increased tonnage on the Pennsylvania Division. The development of the bituminous coal traffic from the territory adjacent to this division continues to be satisfactory and branches and connections now building are expected to increase still further the revenue from that source. The detailed plans for the construction of the new terminal station in New York City and the installation of electricity as a motive power for suburban traffic are under consideration, and the plans for the approaches north of the Grand Central Station have been approved by the city authorities and work upon the depression of the tracks and also upon the construction of the viaducts to carry the streets to be opened will be begun at once.

The following is a summary of some of the most important statistics of operation:

	1903.	1902.
Freight earnings	$46,858,713	$40,659,779
Passenger earnings	23,581,576	23,807,085
Total earnings, including misc.	77,605,778	70,903,868
Maintenance of way expenses	10,469,570	8,600,032
Main. of equipment expenses	10,882,375	9,270,964
Conducting transportation	30,317,130	27,205,999
Total expenses	53,459,314	46,863,489
Net earnings	24,146,464	24,040,379
Gross income	29,419,208	28,916,402
Net income	9,024,303	8,316,718
Dividends (5 per cent.)	6,604,157	5,961,411
Surplus from year's operations	2,120,146	2,055,307

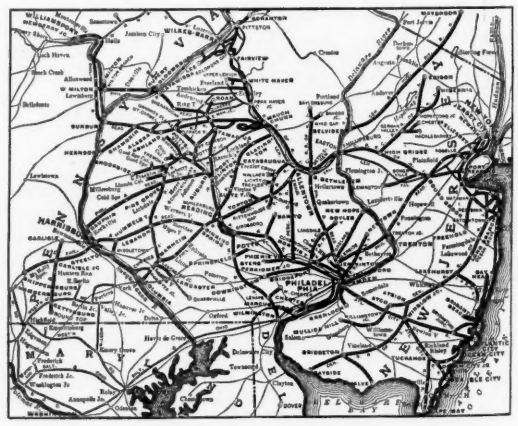
Reading Company.

The joint gross earnings of the Philadelphia & Reading Railway, the Philadelphia & Reading Coal & Iron Co., and the Reading Company, which owns most of the securities of the two previously mentioned, show scarcely any change as the result of operations during the last three fiscal years; 1903 and 1902 are not much different from 1901. The gains made by the railroad have been offset by the decreases in the gross earnings of the coal and iron company, so that although the railroad this year earned four millions gross in excess of the 1901 earnings, there has been a slight loss in the aggregate. In view of the extent to which the Coal & Iron Company was involved in the strike, the slight diminution in aggregate gross earnings would seem to constitute a very favorable showing. The total receipts of the Philadelphia & Reading Coal & Iron Company from anthracite sales during the past year amounted to somewhat over $22,000,000, as against $25,000,000 the year before, and the receipts from combined anthracite and bituminous business, coal rents, etc., were $23,279,241, as against $26,519,529. The accounts of the Reading Company, in its capacity as a holding corporation, show a gross income of $6,340,761, as against $5,229,781 last year.

The large decrease in gross earnings of the Coal & Iron Company is matched by a considerably greater diminution in operating expenses, which amounted in the aggregate to only $20,548,914, as against $25,394,422 last year, so that the profit of operation amounted to $2,730,327, comparing with $1,125,107 in 1902. Fixed charges and taxes were also somewhat smaller in the current year, leaving as income $2,352,579; over three times as much as was reported last year. It is surprising that the net showing is so good, for the extraordinary strike expenditures were large. The railroad company also shows a gain in net earnings, though not so large in proportion. Operating expenses, however, did not increase as rapidly as earnings, and the total surplus from the year's operation is $2,317,515, as against $1,226,412 a year ago. With aggregate gross receipts of the three companies very little improved in the last two years, therefore, it is possible to show net earnings of $5,197,783, before payment of the Reading Company's dividends and the general mortgage sinking fund, as against $2,378,826 last year, and $2,663,087 in 1901.

A charge was made against expenses of $1,228,760 in addition to maintenance charges, to provide for extraordinary betterment work during the year, including extension of main, second and third tracks, yard, depot and shop tracks, etc., new bridges, passenger stations, signals, and real estate. Track was increased 51 miles in this way, of which 6¾ miles was new main line, 14 miles was second track, and 31 miles was sidings. The expenditure on account of main track was principally for the completion of change of alinement, building a connection between the main line and the Norristown & Main Line Connecting Railroad, and branches to the colliery of the Crystal Run Coal Company.

The equipment renewal account was discontinued July 1, 1902, and all expenditure for renewal of equipment is now included in operating expenses, under the head of maintenance. The charge for maintenance of equipment for the last fiscal year was $4,901,011 as against $4,020,222 last year, including $369,979 charged thereto under the head of equipment renewal for the previous fiscal year. The new locomotive shops at Reading, which have been under construction for some time, were finally completed and put in use during the past year. The total cost of the shops was $1,705,668. The main building, or erecting shop, which is said to be the largest of its kind in the country, has a capacity for the simultaneous repair of 70 locomotives. The total floor area of this group of buildings is 388,464 sq. ft.



Philadelphia & Reading.

The total charge for maintenance of way, including the extraordinary expenditures already referred to, was $3,019,881 (as against $2,920,735 last year). This is at the rate of nearly $3,000 a mile, and, taken with the equipment maintenance, makes an aggregate charge of $7,842 per mile of road, for maintenance. This puts the Reading second in the list of leading railroads according to their expenditure for maintenance as shown in a table published in the review of the New York Central report in another column. The figures in this statement are, of

course, subject to slight modifications by reason of differences in policy, some roads including certain items which others do not.

The cost of conducting transportation was $10,566,643, an increase of $1,573,835, in which the largest item of increase was fuel, $890,626 in excess of the charge last year. Train service and the wages of switchmen, flagmen and watchmen increased considerably over $100,000, chiefly caused by the increase, amounting in most cases to 10 per cent., corresponding to that made by other railroads, in the wages of all employees receiving under $200 a month, beginning Nov. 1, 1902. In connection with this increase, any discrepancies existing in the rates of pay in the company's employees in comparison with the wages paid by competing and connecting railroads were adjusted. The following table shows statistics of income of the three companies:

	1903.	1902.
Miles of road	1,010	1,003
Railroad gross earnings	$31,708,524	$28,620,371
Railroad operating expenses	19,092,084	16,543,776
Railroad net earnings	*11,836,527	*10,745,536
Reading Company, net income	6,340,761	5,229,781
Coal & Iron Co. receipts	23,279,241	26,519,530
C. & I. Co. net earnings	†1,147,993	†236,327
T'l gross receipts of 3 companies	62,140,743	61,004,494
Total gross expenses	42,815,463	44,792,850
Total fixed charges and taxes	14,127,498	13,832,817
Total net, before payment of Reading Co.'s dividends and Gen. Mortgage sinking fund	5,197,783	2,378,826

*After appropriation for betterments. †After payment of interest on debt to Reading Co.

New York, New Haven & Hartford.

When this company a year ago published its report for 1902, showing surplus from operations of $382,291, after a prosperous year, it looked as if there might ultimately be difficulty in continuing the 8 per cent. dividend, in view of the fact that $16,397,200 debenture certificates bearing interest at 4 per cent. were to be converted into capital stock on April 1, 1903, and that an additional annual sum of $655,888 would be required thereafter for dividends on this stock. The full effect of the conversion has, of course, not yet been felt, since the increased interest applies on only three months of the current fiscal year; but three other unfavorable circumstances of quite a different character have affected the profits of operation; in the increased cost of coal, due to the miners' strike, increased wages, and the car service charge under the per diem rule. To what extent the New England roads have a just car service grievance need not here be discussed. It is sufficient to note that in 1902 the New Haven paid $780,214 for car service in excess of the amount received from other companies, while this last year it paid $1,237,622, an increase of $457,408, or over 58 per cent.

New York, New Haven & Hartford.

In spite of setbacks, however, the company has had another prosperous year, with total gross earnings from operation of $47,296,077, as against $43,521,087 last year. Operating expenses increased from $31,273,874 to $34,955,023, constituting 73.91 per cent. of gross earnings as against 71.86 per cent. last year. After payment of taxes, interest, rentals, and three quarterly dividends on the old stock, and one dividend on the stock as increased by conversion of the debentures, a surplus from operation of $208,534 is carried forward to profit and loss, as against $382,291 last year.

For several years a large sum for extraordinary betterments has been charged directly against maintenance, including the costly Bridgeport improvements, car shops at Readville, grade crossing elimination, new bridges, passenger stations, etc. The work has now progressed sufficiently so that it was possible this year to charge against operation $1,535,891 less than was charged during the previous year for work of this character, the total maintenance charge being $10,427,641 as against $11,583,910 last year. The progress which has been made on the track elevation and change of alinement through Bridgeport also gives reason to suppose that a lessening in the charge against operation on this account will soon appear.

Of the total receipts from operation, freight traffic this year contributed $23,926,150 and passenger traffic $22,953,017, so that the excess of freight over passenger is now greater than ever before. It will be recollected that as recently as 1898 passenger receipts were greater than freight. How the proportion will be affected by the policy of the new president is an interesting question to be answered next year.

The increase made last summer in wages, in part directly and in part through reduction of hours, occasioned on additional yearly expense estimated at $800,000, and to assist in meeting this and other increases in expenses, a slight advance was made in local freight rates. The capital stock will be increased on Jan. 2, 1904, as authorized last April, by the amount of 10 per cent. of the number of shares outstanding on May 15, 1903, and the proceeds of the sale of the stock, after the payment of a temporary loan of $1,500,000 and of the $2,000,000 first mortgage 4 per cent. bonds, which matured on June 1st, will be used to pay for additional rolling and floating equipment. The total amount of stock now outstanding is $70,897,300.

Statistics of operation follow:

Average mileage worked	2,027	2,027
Passenger earnings	$22,953,017	$21,223,631
Freight earnings	23,926,150	21,871,642
Gross earnings from operation*	47,296,077	43,521,087
Operating expenses	34,955,023	31,273,874
Total income	12,906,872	12,860,273
Fixed charges, taxes and rentals.	8,079,900	8,181,415
Balance applicable for dividend	4,826,972	4,678,859
Dividends (8 per cent)	4,618,438	4,296,568
Surplus for year	208,534	383,291

*Exclusive of water lines, the income from which appears as dividends received on investments.

St. Louis Southwestern.

It is interesting to note that although the St. Louis Southwestern proper shows a fair increase in net earnings, the income account of its subsidiary company, the St. Louis Southwestern of Texas, again shows a deficit in net receipts for the year. This is due, in part, to the continuous rains during six months of the fiscal year in the territory traversed by this latter company, which necessitated extra expenditures on roadbed. The result on the whole system is not so unfavorable as the decrease of $71,782 in net earnings would indicate. Gross receipts show slight changes, being $7,278,575 against $7,267,260 in 1902. Earnings from miscellaneous sources increased $55,573, partly offsetting the loss in passenger and freight earnings. The decrease in freight earnings was due to a smaller grain and cotton crop in Texas for the past year. Although cost of conducting transportation decreased slightly, increases in maintenance of way, maintenance of equipment and general expenses resulted in a total increase of $83,097 in operating expenses. These increases were due, chiefly, to damage to roadbed through abnormal weather conditions, car shortage and embargoes placed on traffic by congestion on connecting roads. Notwithstanding the decrease in net earnings, the net surplus for the year after providing for all fixed charges and full interest on outstanding second mortgage income bond certificates was $564,375, an increase of $24,951. This increase is due to the fact that no payments for new equipment were charged to income account, as in previous years, and also to the refunding of two-thirds of the outstanding second mortgage income bond certificates in exchange for first consolidated mortgage bonds. The interest on these new first consolidated mortgage bonds amounting to $478,852 is charged against income. Interest amounting to $269,540, however, is saved on the second mortgage income bond certificates refunded, which, less the interest on the remaining portion still outstanding leaves a net surplus for the year of $564,375, as stated above. From this surplus an appropriation of $544,765 was made for improvements to roadbed and for additional equipment, and the remainder was added to the credit of net income, leaving a balance to profit and loss of $1,677,098. During the year 31 locomotives and 2,143 cars were added to the equipment. Owing to the arrangement made at the close of the preceding fiscal year for the acquirement and funding of equipment trust obligations outstanding, no payments for new equipment were charged against income account. During the fiscal year car trust obligations so funded, matured to the amount of $777,692, leaving a total amount of equipment trust certificates outstanding of $3,519,732.

Traffic returns show that the average train load increased from 256 tons to 282 tons, due to reduction of grades, heavier rails, more powerful locomotives and freight cars of larger capacity. The following table is interesting as showing the marked increase in the average train load on the St. Louis Southwestern proper as compared with the train load on the St. Louis Southwestern Railway of Texas, where few improvements in grade or equipment have been made.

Year ended June 30.	St. L. S-W.	St. L. S-W. of Tex.	Entire system.
1900	292	149	231
1901	318	151	236
1902	344	160	256
1903	384	167	282

The funded debt is now $43,205,750, an increase of $812,000. This increase is due to the issuing of bonds for the following purposes: $480,000 to cover property of the Pine Bluff Arkansas River Ry., 24 miles; $11,000 to acquire outstanding second mortgage bonds of the St. Louis Southwestern Ry. Co.; $280,000 to pay for building a branch line from Noell Junction to Dallas, Texas, 12⅓ miles; and $41,000 to pay for 2.78 miles of additional side track. The following table gives a comparison of the last two years' operations:

	1903.	1902.	Increase.
Gross earnings	$7,278,575	$7,267,260	$11,315
Operating expenses	5,256,164	5,173,067	83,097
Net earnings	2,022,411	2,094,193	*71,782
Net income	1,510,179	1,455,023	55,156
Per cent. expenses	74.44	73.87	...
Surplus	564,375	539,424	24,951

*Decrease.

Minneapolis, St. Paul & Sault Ste. Marie.

The report of this company for the fiscal year ending June 30 shows an increase of 41 miles in the total mileage worked, in accordance with the policy of the company of extending the lines in the Northwest. Branch lines are now being built from Glenwood, Minn., in a northerly direction, and from Birchwood, Wis., to Reserve. These lines will add about one-tenth to the present mileage. Gross earnings for the year were $7,237,264, an increase of $1,036,152. Operating expenses increased $778,295, leaving a gain in net earnings of $257,857. The ratio of operating expenses to gross earnings increased from 47.3 per cent. to 51.4 per cent., owing to extensive renewals of rails, repairs to bridges and buildings and an increased expenditure for repairs to locomotives, and freight cars. As a result, the items of operating expenses showed increases as follows: Conducting transportation, $501,821; maintenance of way, $116,631, and maintenance of equipment, $39,876. During the year, 12 locomotives and 574 miscellaneous cars were added to the equipment. Property costing about $321,000 was also acquired for terminals at St. Paul, and additional land was bought at Minneapolis for a like purpose, at a cost of $55,000. From surplus, $200,000 was appropriated for betterments, leaving a net surplus for the year of $1,464,497, an increase of $177,996. Passenger earnings increased $267,340 and freight earnings increased $668,512. The revenue ton mileage increased approximately 12 million units, and the average freight haul and rate per ton per mile also increased. The average train load showed a decrease from 314 tons to 305 tons. The result of the year's operation as compared with the previous year is as follows:

	1903.	1902.	Increase.
Gross earnings	$7,293,743	$6,257,591	$1,036,152
Operating expenses	3,719,922	2,941,627	778,295
Net earnings	3,573,821	3,315,964	257,847
Fixed charges, taxes, etc.	1,909,323	1,729,463	179,860
Surplus	1,664,497	1,586,501	77,996

NEW PUBLICATIONS.

Compressed Air. By William Charles Popplewell. Manchester: The Scientific Publishing Company. 284 pages. Price 7s. 6d. net.

The author does not present this as an exhaustive treatise on compressed air. His object is to discuss some of the more important points on air compression and transmission. The opening chapter is devoted to the general principles of pneumatic transmission of power, following which air machinery and appliances are taken up, the theoretical discussion of the subject being reserved for the final chapters. Four chapters are devoted to air compressors, the types described being mostly British; the Westinghouse air-brake pump and one other American type are shown. In the chapter on motors there is a reference to the compressed air cars of the 125th street line, New York, which would indicate that the author is not aware that these cars have not been in service for about three years. A chapter on methods of conducting tests contains some points of practical value in making trials for efficiency. An appendix includes a number of diagrams, containing desirable information in graphical form. The credit for the present improved condition of compressed air engineering is properly given to American engineers.

Electric Railway Economics. By W. C. Gotshall, New York: McGraw Publishing Co., 1903. 252 pages. Price $2.

This book is based on a series of lectures delivered last spring at Lehigh University, dealing with the economics of the preliminary engineering determinations and with the construction and operation of high-speed interurban electric railroads. Taking up the project from the preliminary office investigation of the probable earnings and expenses, it carries it through the course of tracklaying and construction until it is ready for operation. Part of the book is devoted to a statement of the prin-

ciples which should be followed in locating a proposed route so as to derive the maximum benefit from the territory to be served. The detail costs of operation and their computation for different schedules are discussed at some length and analyses and applications are made of the results obtained on existing lines. The relatively great cost of high speeds is strikingly shown by numerous tables and diagrams of the relation between energy consumed and the schedule time for different speeds and number of stops between two points. The last chapter is a set of complete specifications for the construction of a modern high-speed electric road of moderate length, operating over private right-of-way. The author has not only set down the present-day principles of engineering and operation for this class of railroad; he has looked into the future development to such an extent that even in this day of rapid and revolutionary changes, his book will still be valuable many years from now, not as showing what has been done but what can be done. The book contains 252 pages, numerous diagrams and tables and a comprehensive index.

Machines and Tools Employed in the Working of Sheet Metals. By R. B. Hodgson. Manchester: The Technical Publishing Co., Ltd., 1903. 311 pages. Price 4s. 6d. net.

This work presents in book form a series of articles which appeared originally in *The Practical Engineer.* It covers in a quite complete and instructive manner a subject which has previously been little dealt with by writers on mechanical subjects. The author says in the preface that the production of tools for working sheet metals is a distinctly separate branch from engine-fitting and general machine work. It is therefore difficult for an engineer to grasp thoroughly the work of a press-tool maker unless he has had an opportunity of watching closely the tool work in progress and the subsequent operations performed by the tools in the production of articles from sheet metals. The first 11 chapters are devoted to describing the different processes for producing sheet-metal forms and the methods and mechanisms employed; detail drawings accompany the descriptions wherever necessary. Following this are chapters on special forms of presses, with illustrations of typical commercial machines, on stamping, and on automatics and machine tools. A part of this latter chapter discusses briefly the extent to which automatic tools should be used in producing sheet metal forms, the author believing that there are cases where their use is of doubtful economy. The final chapter contains information for practical mechanics on the pressures for cutting blanks, the work done in copying presses—fly and screw presses being compared—and of the work done by a stamp hammer.

Testing of Dynamos and Motors. By Charles F. Smith. Manchester: The Scientific Publishing Company. Price 5s. net.

This book is intended as an elementary introduction to the study of continuous-current dynamo machinery. The methods of carrying out a number of typical tests are described, and some of the conclusions to be drawn from the results are pointed out. The use of mathematics has been avoided as much as possible. There are 29 experiments in all, which have been arranged in a progressive series to illustrate successively the functions of the different elements of the machines. By following the outline suggested, the practical man can obtain a sound knowledge of the underlying principles of this class of machines, and the young engineer can familiarize himself with the behavior of a dynamo or motor under different conditions. The next to the last chapter contains miscellaneous tests, including insulation tests, determination of the leakage coefficient of the magnetic circuit, measuring the voltage around the commutator, etc. The final chapter contains some experiments intended to enable the student to learn some of the important special uses of dynamos.

TRADE CATALOGUES.

The Lidgerwood Mfg. Co., New York, has published a handsome catalogue describing the work of the Lidgerwood rapid (plow) unloader. The book contains halftone engravings of the machines at work and contains some convincing figures on their economy. Ballast can be placed alongside the track at a cost of from 4 to 6 cents a yard, using steam shovels for loading and a train of ordinary flat cars with aprons between the buffers. The plow is sufficiently powerful to unload any kind of material at the rate of 125 linear feet per minute. By moving the whole train either forward or back the load can be distributed for any distance along the track, or deposited in one place.

The Alexander Car Replacer Mfg. Co., Scranton, Pa., has gotten out a small pamphlet containing a list of users of the Alexander car replacer and a few illustrations showing the machinery used in making them. These replacers are made in three sizes for different heights of rail and come in pairs, one for the inside of the rail and one for the outside of the rail. They weigh about 150 lbs. per pair for the largest size.

R. Woodman Mfg. & Supply Co., Boston, Mass., has issued an illustrated catalogue of railroad and ticket office supplies. This company makes all kinds of ticket punches, dies, baggage checks, uniform finishings, buttons and miscellaneous supplies of that nature, most of which are illustrated, with price lists, in the new catalogue.

The American Locomotive Sander Co., Philadelphia, is sending out a pamphlet on locomotive sanders and sanding. The contents are devoted mostly to the different types of Leach sanders. One other kind, the "She," is shown. Information on the most suitable types of sanders to use for different classes of service is included.

The Ingersoll-Sergeant Drill Co., New York, has issued a reprint of its old catalogue on compressors to supply its needs pending the completion of a new catalogue now in course of preparation. The reprint contains some new illustrations, and the tables of standard sizes of compressors have been revised and brought up to date.

Bulletin No. 38 of the Crocker-Wheeler Company, Ampere, N. J., on small motors, is devoted to the Form L. The principal detail parts are described and illustrated by half-tone engravings. Two views of an assembled motor are also shown and several views of applications to machine tools.

Falsework for Rocky Bottoms in Rapid Currents.

The report of the committee of the Bridges and Buildings Association, appointed to submit designs for falsework where piles cannot be driven, contains drawings of a number of designs used by members of the association in special cases. The report says:

The committee agrees that no particular plan will fit all cases. Nevertheless falsework constructed as described

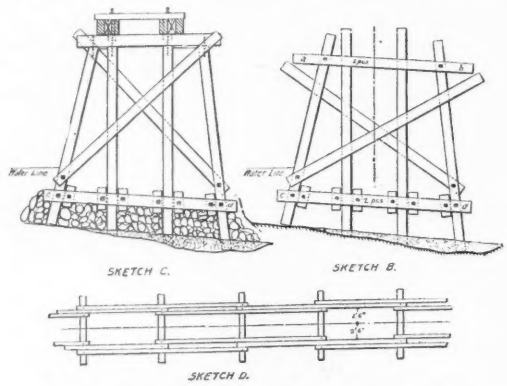


Fig. 1.—Falsework for Rocky Bottoms in Rapid Currents.

below, although it may not be the best in every case, will be found practicable in all locations.

1. Get approximately the height of horse at both up and down-stream ends by sounding, and construct bent on shore as shown in Sketch B. This should be made of squared timber if available, although round timber will do. As horse is pivoted at four points, its shape may be changed considerably. The upper ends of sway braces and the tops of the two interior posts are to be held temporarily in position by lashing.

2. Swing into place with pile driver or derrick car if on hand; otherwise by shear pole. If current is very strong, load rails or scrap iron on bottom brace *c d*. Guy bent on each side of stream, both above and below the bridge site, and when horse has been lowered to rest on river bottom, tap the top of each post with pile-driver hammer if available; otherwise a heavy weight, handled by any convenient rigging will answer, making sure that

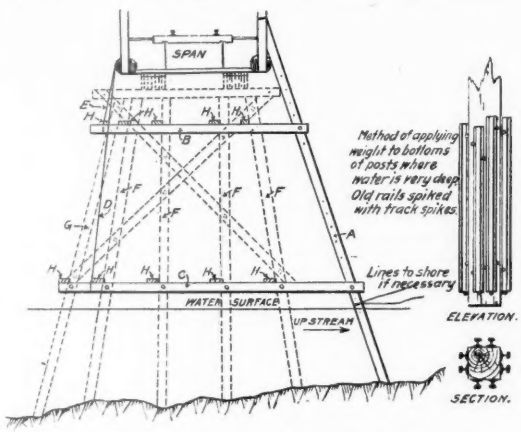

SPAN
Method of applying weight to bottoms of posts where water is very deep. Old rails spiked with track spikes.
Lines to shore if necessary
WATER SURFACE
UP-STREAM
ELEVATION.
SECTION.

Fig. 2.—Method of Placing Falsework Under Old Iron Bridges on Southern Pacific.

posts are all down to a solid bottom. Posts are then sawed off to proper grade, cap placed, braces *a b* taken off, and sway braces spiked securely.

Sketch A is a horse with three legs resting on small boulders with only one leg on the solid bottom. [This sketch not shown.] Sketch B shows position of same horse with legs all driven down to solid ledge. The two inside posts are not bolted or spiked to any of the braces and may be plumbed and then driven after the two outside posts have been forced down to a solid bottom.

Sketch C shows same horse finished with track in place. Space bents as far apart as strength of stringers and length of same will permit. Place two stringers under each rail, arranged as shown on Sketch D and drift-bolt securely. Use sawed bridge ties if available; otherwise ordinary track ties, spaced 18 in. on centers. Spike each end of every tie to stringers.

A double-track bent may be made in a manner similar to the above by increasing the length of braces and inserting four or more interior posts instead of two, as shown, but it would seem advisable in case of a washout to get trains over an opening on a single-track trestle and then go back and take care of the other track.

If the timbers are not sufficiently long for posts, one or more decks may be constructed in the usual manner on top of horses built and placed as described.

3. Horses designed as shown in Sketch B will apply to rebuilding trestles permanently or may be used for falsework in erecting new structures, as well as in case of a washout. Of course, in the first two mentioned cases, soundings may be taken more accurately and an allowance made in the length of posts for the profile of river bed so as to have bent fit track better than in the hurry and "anything-to-get-there" of washout construction.

In places where falsework is desired to carry trusses which are to be removed, also new trusses and traveler for erection, a modification of this design may be made to fit each case, preserving, however, the adjustable feature.

4. It is probably advisable in cases where structures are being rebuilt, which span an opening where there is sufficient water to float horses to position, to erect bents by rigging attached to existing bridge; nevertheless, a car pile-driver or derrick car should be at hand.

Mr. F. S. Edinger, of the Southern Pacific, submitted some interesting plans which are shown in Figs. 2 and 3. Fig. 2 shows the way in which falsework was placed under some old iron bridges which were to be replaced with heavier steel spans. The stream was very rapid, and in most cases the rock bed was comparatively free from gravel, though large, irregular masses of volcanic rock were plentifully strewn over it. The height from the rail base to bed of stream ranged from 25 to 50 ft.

The timber A, 12 in. sq., was first bored to receive bolts from girts B and C, the holes being 8 or 10 in. apart, and covering the probable range in position of girts due to irregularity of bottom. It was then lowered outside of the up-stream truss directly opposite the proposed position of the bent, with the lower end resting on the bottom several feet further up stream than the posts of the bent were likely to be set. If necessary it was secured in position by ropes attached just above the water surface. The top was securely lashed to either a post or the bottom chord of the truss. Girts B and C were then

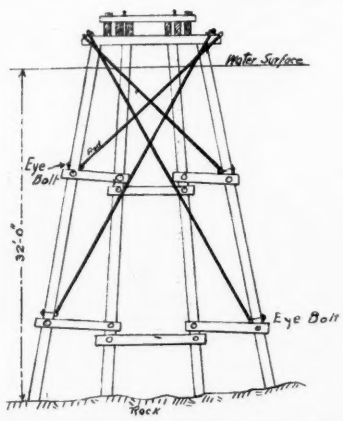


Fig. 3.—Bent of Temporary Trestle Used on Southern Pacific.

lowered to place, and the up-stream ends bolted to A. The down-stream ends were suspended by ropes.

The staging planks H were then run out over the girts, and some of them fastened at both ends, temporarily, to prevent swinging of B and C. The posts F were then lowered to the bottom in the angle formed by H and C—H being temporarily out of position, 2 or 3 ft. up stream. H was then allowed to move down stream along the girt C. The tops of posts F were cut off, and capsway braces and longitudinal girts put on, after which A was removed and used in placing the next bent. Where there was any uncertainty as to the bearing of the posts on the bottom or of the stability of a four-post bent being sufficient, additional posts were put in, as indicated by G.

Fig. 3 shows the method used in the construction of a temporary trestle crossing a lake formed by a landslide damming the stream lower down. The bed of the lake was solid rock, and it was impossible to drive piles. The depth of the water and nearness of grade to surface of the water made it a difficult matter to brace the bents laterally. This was overcome by using short, lateral girts connecting two adjoining posts only. Rods, having eye-bolts attached to one end and long thread and nut on the other, were used for transverse bracing.

The posts were settled to the bottom by tapping lightly with pile-driver hammer, the articulated girts allowing each post to rest on the bottom independently of the others in the bent. They were then cut off and capped, after which the sway rods were fastened to the cap by cutting into the side of the cap to allow them to lay flush with same, and bolting a 4-in. plank to the side of the cap over the rods. Several 80-ft. wooden spans were put into this temporary structure on piers built on the same principle as the above, the girts being articulated both

transversely and longitudinally to allow each post to rest on the bottom independently of the others. These piers were loaded down by laying steel rails across the girts. The structure was remarkably rigid, and answered the purpose very satisfactorily.

The report is signed by J. P. Canty, Chairman; O. I. Killibrew, E. C. Macy, H. H. Eggleston, F. F. Lloyd, J. E. Greiner.

Fig. 4.—Shops of the Pneumatic Signal Company, Rochester, N. Y.—Looking Southwest.

New Shops of the Pneumatic Signal Co.

The Pneumatic Signal Company, of New York and Rochester, has lately completed at Rochester extensive new shops for making signals, and the plant is now running, employing about 360 men. The works are situated about two miles west of the center of the city, and the main line of the New York Central lies a few rods to the north. The arrangement of the buildings is shown in the drawing. The railroad tracks leading out of the yard at the east end converge into a connection with a freight track owned jointly by the three railroads entering Rochester—the New York Central, the Pennsylvania, and the Buffalo, Rochester & Pittsburg; so that the facilities for receiving and shipping freight are all that could be desired. The track connecting with the Charlotte line of the B., R. & P. at the west side of the grounds is on a trestle, level with the main line but 20 ft. above the level of the yard, so that coal, most or all of which is received by this line, is unloaded into the bins without lifting. All of the standard railroad tracks in the yard, except this coal track, are so graded as to bring the car floors on a level with the shop floors.

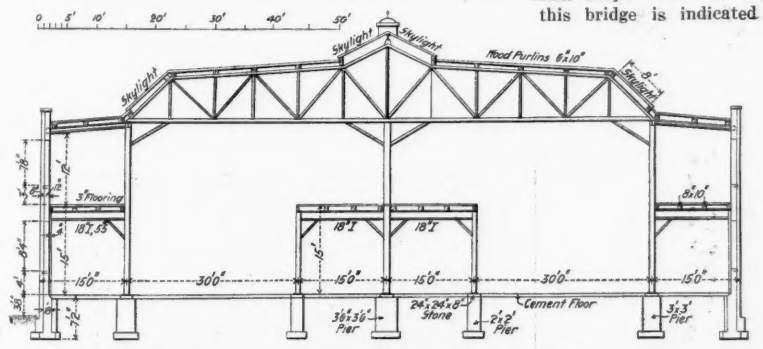


Fig. 2.—Transverse Section Through Machine Shop.

The principal buildings consist of a foundry 288 ft. x 60 ft., with adjacent store rooms, core room, tumbling room, and sand and coal storehouse; a machine shop 240 ft. x 120 ft., with galleries; a store room 240 ft. x 60 ft.; a carpenter shop 110 ft. x 60 ft.; a pattern shop 50 ft. x 60 ft., and a forge shop 135 ft. x 60 ft. The situations of the different buildings as related to each other may be traced by following the line of the "industrial" railroad, which runs to every part of the works. This railroad, which is of 21 in. gage, is indicated on the plan by a solid line, with crosses in circles at the points where there are turntables. This track is for transferring heavy articles on four-wheel lorry cars and the material for it was furnished by Arthur Koppel. Beginning at the sand and coal storehouse, into which the material is deposited from freight cars, this track runs to the cupola room, to the molding room of the foundry, to the core room, to the tumbling room, to the casting store room, and thence to the machine shop. In this shop the track makes a complete circuit, as shown. The store room for finished materials has three tracks its whole length. The branch track between the machine shop and the store room runs to a lift bridge which connects the main shops with the carpenter shop. The location of this bridge is indicated by the dotted line.

All of the buildings are of brick with roofs supported by metal trusses. The floors in all of the buildings except the foundry and the carpenter shop are of cement, and the rails of the industrial tracks are laid with tops flush with the floor.

From the machine shop the lorry track runs to the forge shop. The line extending eastward from this shop runs through the metal storeyard.

The power for running the machinery is produced by a 250 h.p. Westinghouse engine, direct connected to a 200 k.w. General Electric generator of 250 volts. Steam is supplied by two boilers, each of 200 h.p., made by Altman Taylor Company, and the fuel is bituminous coal. All the buildings are heated by exhaust steam. Water is supplied by driven wells and a supply is stored in a reservoir in the ground, as shown, and also in a tank holding 50,000 gallons which is on an iron tower 100 ft. high, providing pressure for fire purposes. The ordinary pressure is 50 lbs. per sq. in., and this is carried throughout the grounds by 8 in. pipe lines. There are 10 fire hydrants, each housed in a small cabin containing the hose and tools. In case of fire the pressure can be increased to 100 lbs. per sq. in. by the use of the larger of the two pumps in the engine-room. The water tower was built by the United States Wind Engine & Pump Co.

The iron for the foundry is melted in a 10-ton cupola and at present about 10 tons of castings are made daily. There is an overhead trolley track for distributing the loaded ladles. This appears in Fig. 3. Adjoining the cupola room is a separator for washing the slag and saving the iron therefrom.

The machine shop is so designed as to give an abundance of light in all parts. A transverse section of this building is shown in Fig. 2. The space beneath the gallery is used mostly as a storeroom for small finished articles and as a tool room. Those parts of the main floor at the sides, beneath the side galleries, are well lighted by the windows in the wall, and on all other parts an abundance of light falls from the one center and two side skylights, as shown. These skylights are continuous the length of the building, and those on the sides are so situated that even the space under the central gallery is pretty well lighted.

Fig. 3.—Foundry.

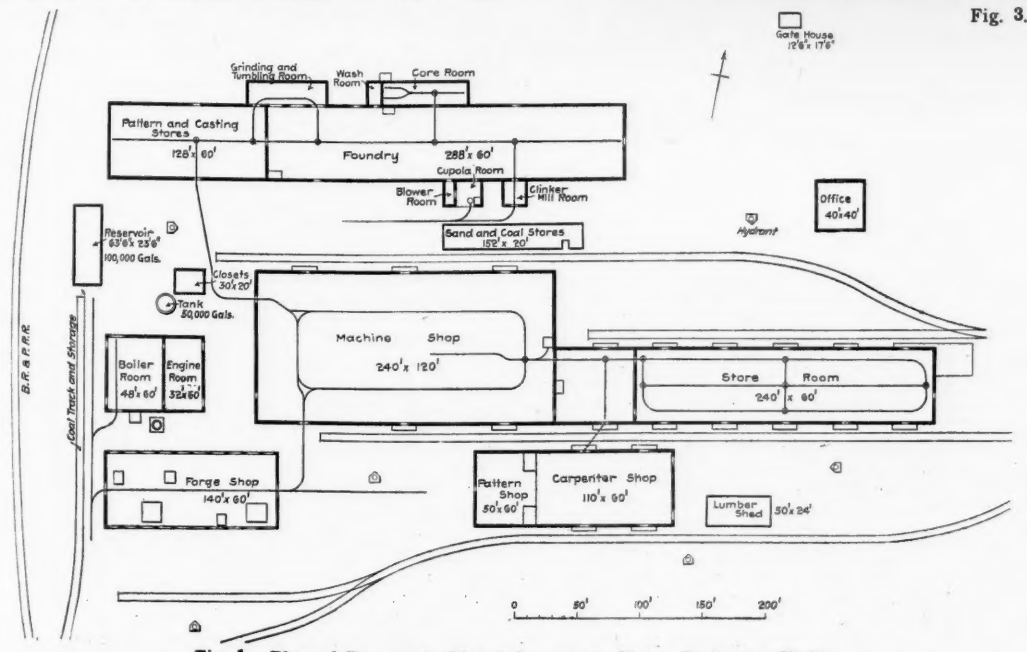


Fig. 1.—Plan of Pneumatic Signal Company's Shops, Rochester, N. Y.

It will be noticed that the brick side walls of this building rise about 2 ft. above the level of the roof; rain water is conducted to the sewers by pipes running down inside the main wall. The machines in the machine shop proper number 69, and the total number in the works is about 150. There are seven planers, 16 lathes and 28 drill presses. Of electric motors there are eight, and there are no long lines of shafting.

The largest multiple drill press, No. 30, made by Prentice Brothers, drills at once eight holes each 1½ in. in diameter. This and the other presses of this size also turn ⅞-in. pins at the same rate. Each of these machines is run by a 5 h.p. motor. Smaller machines are grouped and run by motors of suitable size. Planer No. 5, made by Putnam, has an attachment to plane on curved lines, and is used to finish the inside surfaces of the links for mechanical signal levers and also for planing the segments. Two 48-in. planers made by G. A. Gray & Co. are used for planing locking plates. One of these machines planes 36 surfaces at once. Each machine has an independent motor.

Many of the machines are new, though a large number came from the shops at the company's former headquarters in Troy. The care and discrimination with which machines have been selected for particular uses is indicated by the fact that the inventory shows the names of 48 makers, and there are numerous items marked "no name" or home made.

The office building is of brick, three stories and base-

ment. This building is occupied by Vice-President Charles Hansel, Chief Engineer F. L. Dodgson, Superintendent W. W. Lavarack, Assistant Treasurer J. R. Coleman, and Purchasing Agent H. C. Frey; and by the drafting and electrical testing departments. The latter is well equipped for making all desired tests of electric signal apparatus.

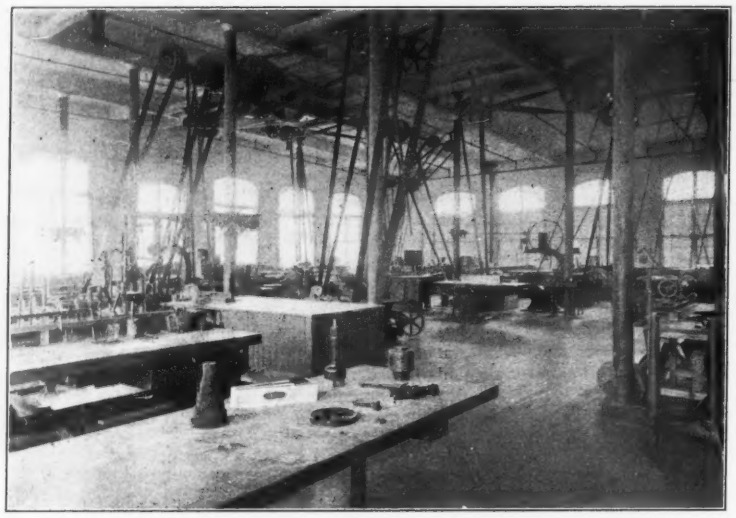
"You Can't Have Too Many Grab Irons."

At the Northwest Railway Club's discussion of grab irons on locomotive front ends, an old trainman on the Northern Pacific, J. S. Page, was invited to speak, which he did fluently in a breezy address that is mainly valuable for its picture of a trainman's work.

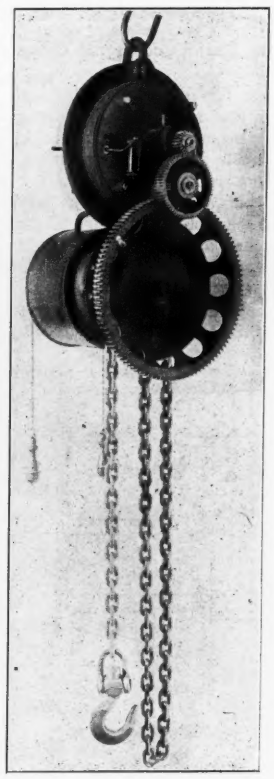
"Mr. President and gentlemen, as a trainman I have been in service about 21 years. My experience is you can't have too many grab irons, if you have them all over the car. I have seen many a man killed because there were no grab irons. A grab iron is a very small expense. A grab iron on the front of the engine, I think, is a necessity. There will never be a time when men won't get on the front of the engine unless there is an order from the superintendent that he will be discharged if he does. I am running a train where we have nearly all spurs, and we make a great many 'flys,' and the brakeman has got to stand on the pilot somewhere, or on the car ahead of it in order to cut the car off. Now, if he has no grab iron or steps on the pilot, and no lever to lift the lock to open the coupler, he has got to get on the front car; he stands on the brake with his feet, if it is an outside hung brake and holds onto the end of the grab iron and pulls the lever out and releases the car when it is going, and the other man pulls the switch. I never ran a train on the N. P. that didn't make from one to five 'flys'; and lots of times one brakeman makes the 'fly' alone. It is all down hill; he can start the car, standing on the pilot, pull the bar, let the engine run down, jump off and throw the switch. Now, they stand on the pilot, and they will stand on the pilot just as long as there is a pilot on an engine. My men do it every day in the week, and half a dozen times a day. There is a space runs down from the draw-head to the pilot—about that far; it makes a good step right on the nose of the pilot; they will get on there just as sure as the engine comes to them, and if you have got no grab iron there, there is nothing to catch, but they grab the chain that lifts the block, or grab around the drawbar itself. If you have not got a grab iron, or step there for them to stand on, there is just that much more danger. Now, a switching engine in a switching yard where they have time, and have good ground to go over, is not like a road engine. A road engine should have better appliances for saving the men than a switch engine; they have to make all kinds of plays to do the work quickly; they need all these appliances much more than a switching engine. A road engine ought to have a footboard all around to make it safe. They have got to get onto the engine; they will get on the cab, and when they come up to the car they have got to run the length of the tank to get back to the car they're coming up to; they don't want to stop the engine in all cases; sometimes they will stumble when the snow is sliding down on the bank; if there is a footboard there they will get on and they will run the length of the engine, pull the knuckle pin when the engine is going and they won't have to stop the engine. Now, if you are going to have a solid drawbar, that engine has got to stop, because he has got to go to the box car and open the knuckle. Now, on the front end of the engine, if it is a solid knuckle, there is a loss of time; you are coupled onto the car, the block won't raise, the block won't disconnect; what are you going to do? You have got to take a bar and work five or ten minutes before you could get that lock block up. Very frequently that happens; take 10 or 15 minutes on the road; you are delaying trains. If you come to a sharp curve you have got to open both knuckles in order to make your coupling on the curve. If one knuckle is solid, you have got to back the train down to the straight track before you can uncouple the engine. If a road engine does the same amount of work as a switch engine you have to work a great deal quicker. I can't see but what the more grab irons you get on cars, no matter where you get them, the safer it makes it for the men to handle the cars. You don't need more irons on the side of the cars; the ladders on the cars make a grab iron; you don't need a grab iron on the side, unless it is a flat car. The new style of flat car has got a step for a grab iron on the end; it is called the ladder step, where they get on the end of the car. My experience is you want knuckles on both ends. I have had experience with all of them, and you need all of them; more on the road than you do on a switch engine."

New Foundry and Pattern Shops of the B. F. Sturtevant Company.

A plan of the new plant of the B. F. Sturtevant Company at Hyde Park, Mass., was shown in the *Railroad Gazette*, Oct. 17, 1902. The article accompanying the plan explained the controlling conditions and the reasons for the arrangement and construction of buildings adopted; also a general description of the buildings and the methods to be used was given. With two or three slight modifications the plan then shown has now been executed. The foundry and pattern departments were the first to be put in operation prior to the removal of the entire plant from Jamaica Plain, Mass.



Pattern Shop.



Sturtevant One-Ton Electric Hoist.

Bench Moulders' Floor.

The pattern building is divided midway of its length by fire walls enclosing stairs, elevators, etc. One-half the building, with stories respectively 17 and 15 ft., is devoted to the flask and pattern-making rooms, while the other half, provided with intermediate floors—four in all—is for pattern storage. The flask-shop, 60 ft. by 80 ft., is equipped with band, cross-cut and splitting saws, boring machine and lathe, all driven by a 10-h.p. Sturtevant motor suspended from the ceiling. An industrial railroad runs directly into this room from the foundry, and together with an over-head transfer truck reduces to a minimum the cost of handling flasks. This room also includes the metal pattern-makers' department equipped with the necessary machine tools. Adjacent to it is the locker, wash and toilet room for the building.

Immediately above, is the pattern shop abundantly lighted upon three sides and equipped with a full complement of tools including one single and two double saw benches, two band saws, a buzz planer and a double surfacer, five lathes—one a 66 in. x 11½ ft. gap lathe—a drill press, a core-box machine, numerous wood trimmers, etc. All the power machines are driven by two 10-h.p. Sturtevant motors, both being required for ordinary work, but one always serving as a possible relay in case of accident.

The benches, which accommodate two men each and are 2 ft. 6 in. wide by 16 ft. long, are so arranged along the sides of the building that the men receive a left-shoulder light. Behind each bench is a working table 4 ft. wide by 16 ft. long. The benches are supported by cast-iron legs of special design, built by the Sturtevant Co., the same design being used throughout the plant. They are equipped with Emmert vises and their tops are heavy maple plank. A drying chamber for glued work is provided.

Around the pipe columns which support the floors of the pattern storage end of the building are clamped the pattern shelving brackets which are adjustable to any height. All patterns are consecutively numbered upon the drawings as made. When the patterns are delivered to the pattern storage department proper locations are assigned and records made upon cards, one for each pattern. These cards are filed in the order of the pattern numbers. Four figures with the addition of a letter are sufficient to locate a pattern. A given location, for instance, may be 2125B; that is, it is upon the second floor, as shown by the first numeral, it is in the twelfth row of shelves and the fifth division of that row, and on the B level, the floor level being A, and the letters B, C, D, etc., indicating the shelves in their order above.

The first floor is concrete and is for heavy cast-iron patterns. It is served by an industrial railroad and turntable for transfer to the elevator and thence to other floors. Communication between the pattern shop and storage department is direct, while the fire risk is reduced to a minimum by a double system of fire doors.

Brick division walls 3½ ft. high running lengthwise of the foundry separate the floors on the lines of the columns. Lighting is secured through monitors in both of the craneways and through side windows. Each line of monitor transoms is operated in unison by a novel device of the G. Drouve Co. The western side of the foundry is for bench and small floor moulding, the bench moulders' floors being separated at the bench ends by wooden partitions. The floors in this side of the building as well as those in the storage bins and center runways are concrete. Alongside the industrial railroad, which serves iron from ladle trucks to the bench floors, is a sunken trench, laid with common brick, for drippings and for piling hot castings.

In the center line of each of the craneways and in the bent between them is an industrial railroad with turntables connecting with the cross aisles, for the distribution of metal, etc., to all parts of the building. The floor between the craneways is supplied with a series of 1½-ton small traveling cranes of 10-ft. span equipped with Sturtevant electric hoists built especially for this work. All materials are received from a track which runs along one side of the foundry and are delivered through wall openings to bins.

An ingenious system of charging has been devised by which the charging cars pass at floor level in front of the bins, are loaded, weighed, and passed to the elevator to be raised to the charging floor. As each car is unloaded it is pushed forward and started down an incline in a direction opposite to that traversed on the floor beneath. A novel apparatus gradually brings it to a standstill while yet on the incline, and then releases it so that it may, by its own weight, roll onto an elevator which is automatically tripped and descends to the ground floor level.

There are two Whiting cupolas 56 in. and 72 in. in diameter respectively. A No. 8 and a No. 10 Sturtevant pressure blower driven respectively by a 30 and a 40-h.p. Sturtevant belted motor are supported upon the charging platform and discharge directly downward to the cupolas. It is intended to make this installation the subject of critical experiment for the establishment of important principles.

The entire transportation equipment, including tracks, turntables, cars, trucks, etc., was designed and built by the Sturtevant Co. The tracks in the foundry are imbedded in concrete runways and all changes of direction are by turntables, there being no switches in the works, and therefore no radial truck cars, all cars having rigid bases. The cars have a special type of ball bearing which is practically devoid of machine work, but with chilled wearing surfaces. The ordinary flat cars as well as the charging cars are built of structural steel. The geared ladle cars have malleable-iron frames and enclosed spur-gear mechanism. Similar construction is used in the case of the transfer cars for geared crane ladles of medium size, while a simple low-platform truck is used for the largest crane ladles. The dump cars are in the form of inverted cones and so balanced as to be tipped with the utmost ease. The taper of the cone is such that these cars are practically self-dumping.

The brass foundry, at one corner of the main building, has four crucible furnaces and a special form of reverberatory furnace designed principally for the melting of babbitt or similar soft metals. An overhead traveler with interlocking transfers on the side floors serves the moulding area of the room. Blast for the furnaces is furnished by a No. 3 Sturtevant "Monogram" blower and the entire machinery, consisting of a sprue cutter, a magnetic separator, a tumbling barrel and emery wheels is driven by a 5-h.p. Sturtevant motor attached to the wall. The entire floor is concrete in which is imbedded a section of the industrial railroad communicating with the rest of the foundry.

In the middle of the end of the foundry is the core room. There are six ovens, three being 7 ft. in diameter, of the reel type, and three being respectively 4, 5 and 7 ft. wide by 8 ft. 10 in. long, provided with cars. An overhead traveling crane serves these latter ovens. A part of the room is partitioned off for the women core-makers employed. The floor is concrete. The tops of the ovens

are utilized for storage of cores upon a special rack of steel construction. A Blake wire-straightener, driven by a 5-h.p. Sturtevant motor, together with a Hanna pneumatic shaker are the principal machines in this room.

At the other end of the foundry is the cleaning room, through which run the longitudinal tracks from each main aisle of the foundry. A 5-ton three-motor Whiting electric crane with Sturtevant motors, serves the principal part of the floor. The tumbling barrels, six in number, are completely enclosed in housings of steel plate. These, together with a Sly cinder mill and several emery wheels, are driven by a 30-h.p. Sturtevant motor.

Adjacent to the cleaning room is the pickle room; the floors of both are concrete. The pickle beds are of teeterboard construction so designed that the acid may be drained back into the vats and the board subsequently teetered over for washing into the trench upon the other side of the room. The floor slopes to give perfect drainage. A pneumatic traveling crane serves this room.

The sanitary arrangements are good. The foundry has a large locker and wash room. Expanded metal lockers to the number of 225 are already in position. Six enameled iron sinks are served with tempered water. A series of slate partitioned shower baths has proved to be very acceptable during the past summer. The floor of this room is tar concrete.

The plant is heated and ventilated by the Sturtevant system. The heating apparatus operates with exhaust steam. The entire system in each building is under thermostatic control, enabling an even temperature to be maintained. Distribution of air is made through a system of overhead galvanized-iron piping, discharging downward.

A complete underground tunnel system is provided for distribution of steam and return of the water of condensation, distribution of electricity, compressed air, oil, etc., from the power house to the buildings. It is 5 ft. wide and 6½ ft. high.

TECHNICAL.

Manufacturing and Business.

At the meeting of the American Sewer Pipe Company, Pittsburg, Pa., last week Frank Kendolf was elected President.

The Independent Railroad Supply Company, Chicago, reports sales of "Federal" and "Chicago" tie plates to the Colorado Midland.

The De Lavel Steam Turbine Company, New York, has sold to the Mexican Central three 300 h.p. steam turbines for the new shops at Aguas Calientes.

The National Iron & Steel Works Company, of Mexico City, has under consideration a plan for the building of a rolling mill and other improvements.

The American Engineering & Equipment Company has been incorporated in New York, with a capital of $250,000, by F. M. Ashley, A. H. Broza and others.

E. S. Woods will have a permanent office in the Monadnock Block, Chicago, instead of in the Old Colony building, as reported in our issue of October 16.

The American Air Tool Company, of Dunkirk, has been incorporated in New York, with a capital of $300,000. R. J. Gross and F. W. Smith, of Dunkirk, and others are incorporators.

The American Bridge Company has posted notices at the Pencoyd Works that the whole plant, with the exception of the machine shops, steel and iron foundries, will be shut down indefinitely Oct. 31.

The Acton Valley Forge & Casting Company, New York, has been incorporated in New York, with a capital of $25,000. Arthur Hardoucourt, Jr., and O. F. Spencer, of New York, and others are directors.

Richard K. Papin, formerly Superintendent of the North & South Rolling Stock Company, has resigned to become Superintendent of the railroad equipment department of Walter A. Zelnicker Supply Company, St. Louis, Mo.

Percy Jones, formerly Roadmaster on the Kentucky Central (L. & N.), who has recently been at the New York office of the Coughlin-Sanford Switch Co., now represents this company in the west, with headquarters at 510 Monadnock Block, Chicago.

Paul Dickinson, Chicago, reports sales of the "Giant" cast iron smoke jacks for the following roundhouses: Baltimore & Ohio, 24-stalls at New Castle Junction, Pa.; Pennsylvania, 15-stalls at 14th street, Chicago; Terminal Railroad Association of St. Louis, 16-stalls, and Missouri, Kansas & Texas, 15-stalls at Oklahoma City.

T. J. Heller, formerly New York agent for the steel ball department of the Federal Mfg. Co., has resigned to become manager of sales of the ball business of the Standard Roller Bearing Co., Philadelphia, Pa. Mr. Heller will make his headquarters in the office of the company at 48th street and Girard avenue, Philadelphia.

The Standard Roller Bearing Company, of Philadelphia, has purchased the ball business of the Grant Tool Company, Franklin, Pa. The new owner will continue to run the business for a short time in Franklin, so that all orders can be filled without delay, but the business will eventually be moved to Philadelphia and consolidated with the Standard Roller Bearing Company's plant in that city, to which place orders should be sent. R. H. Grant will have charge of the ball making plant in Philadelphia. A number of the former employees of the Grant Company will remove to Philadelphia.

The American Machinery & Export Co., 114 Liberty street, New York City, is in the market for a large amount of wood and metal working machinery and foundry equipment, including a saw bench, pattern maker's lathe, 24 in. x 25 ft. dimension planer, 3 in. hollow chisel mortiser, post boring machine, heavy tenoning machine (double head and double cope), 14 in. x 6 ft. tool room lathe, 1½ in. twist drill grinder, 36 in. radial drill, Jones & Lamson flat turret lathe, 36 in. x 36 in. x 12 ft. and 28 in. x 28 in. x 8 ft. planers; 24 in. x 12 ft., 20 in. x 10 ft. and 30 in. x 36 ft. engine lathes, stationary blast forge and a 3 to 5 ton cupola with necessary blower. Second hand machines, if modern and in good condition, will be considered.

The Crocker-Wheeler Company, Ampere, N. J., has lately received a number of notable orders which have been pretty evenly divided among its larger branch offices, indicating that the improving condition of its business is general. An order from the Lorain Steel Company, Lorain, Ohio, received through the Pittsburg office, called for 41 motors ranging in size from 2½ to 360 h.p., and representing a total of 1,423 h.p. Another large order came from the New Jersey Zinc Company, Hazard, Pa., through the New York office, for one 125 and two 600-k.w. generators and 37 motors aggregating 401 h.p. The Philadelphia office placed an order from the Warren Foundry & Machine Company, Phillipsburg, N. J., for one 200-k.w. generator, four 35-h.p. motors, and two 60-h.p. motors, and through the Chicago office the G. H. Hammond Company ordered for its packing plant at the Union Stock Yards in that city, one 50, one 25 and two 20-h.p. motors, and an 800-k.w., 550-volt, size 896, engine-type generator. This last is a duplicate of one now building for the St. Louis Exposition, the entire intramural plant for which will be operated by generators supplied by the Crocker-Wheeler Company.

Iron and Steel.

The Cleveland Car Specialty Company has been organized by the Cleveland City Forge & Iron Company to make spring planks, brake-beams and trucks.

Press reports state that the Whitaker Iron Company, the Wheeling Corrugating Company, of Wheeling, W. Va.; the Portsmouth Steel Company, of Portsmouth, Ohio, and the Laughlin Nail Company, of Martins Ferry, Ohio, will be merged, the new company to have a capital of $10,000,000.

Reports from Baltimore state that at the marine department of the Maryland Steel Company, at Sparrows Point, nearly 1,000 extra men have recently been put to work. In all the departments of the company 5,000 men are employed, and 300 more will be added to the drydock department. The company is building the freight steamer "Missouri" for the Atlantic Transport Company, and the steel lock for the naval station at Cavité, Philippines, to cost about $1,124,000.

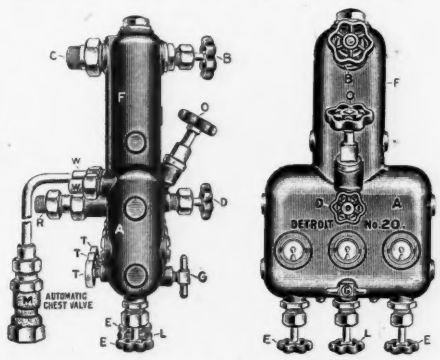
Press reports from Washington state that the Secretary of the Navy has decided to award contracts for furnishing armor plate for the battleships "Vermont," "Minnesota," "Mississippi" and "Idaho," as follows: To the Midvale Steel Co., 6,000 tons; The Carnegie Co., and The Bethlehem Steel Company, 5,000 tons each. The bids of the Carnegie and Bethlehem companies were the same—$6,944,000, delivery to begin in nine months. The Midvale Company bid $6,606,932, delivery to begin in 20 months. The latter company, will, it is said, build a new armor-making plant to cost about $2,000,000.

Block Signaling on the Illinois Central.

The report published widely a week ago to the effect that the Illinois Central would introduce the telegraph block system throughout its lines proves to be untrue—more's the pity. An officer of the road informs us that the company will continue to extend its block system gradually, as has been the policy for the past few years. As the last statistical information received from the company showed 91 miles equipped with automatic block signals, and none with manual, it is to be presumed that the present statement about a gradual extension refers to automatic signaling only.

A New Type of Locomotive Lubricator.

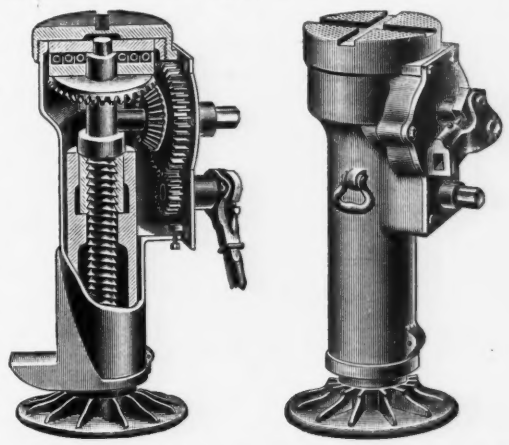
The Detroit Lubricator Co., Detroit, Mich., has recently put on the market a new design of locomotive lubricator shown in the accompanying engravings. The chief advantages claimed for it are safety and simplicity. There



are only about half the number of parts as in the usual forms of lubricators and instead of glass tubes for the sight-feed, round glass discs, 1 in. thick, are used which removes any danger from broken glasses. The oil is delivered to the sight-feed chamber from a point within the oil reservoir, and with this arrangement there can be no chilling of the oil in cold weather. Because of the few joints, the liability from leakage is very slight.

A New Norton Ball-Bearing Jack.

A. O. Norton, 286 Congress street, Boston, Mass., has recently designed and brought out a new ball-bearing ratchet screw jack having a capacity of 60 tons, and intended for use under 80,000 lb. and 100,000 lb. loaded



cars, as well as for wrecking equipment. This jack is similar in construction to the earlier type of Norton ball-bearing jack, in that the gears are cut from solid steel forgings, and it has ball-bearings to reduce the friction. All the working parts are protected from grit and rust, and being a screw jack without filling, packing or valves, it is safe under all conditions; it cannot slip or drop the load, and is always ready for use.

Electro-Pneumatic Interlocking.

The Union Switch & Signal Company has closed a contract with the Interborough Rapid Transit Company, New York City, for all of the interlocking for its new subway railroad. Last May the company took the contract for the block signaling. Most of the interlocking will be Westinghouse electro-pneumatic and it is estimated that there will be 242 levers. The Union Company has also taken a contract for interlocking the Long Island City yard of the Long Island Railroad, which will require about 125 electro-pneumatic levers. The electro-pneumatic interlocking now on the books of the company aggregates 867 levers, which is more of this class of work than was ever in hand before at any one time.

Dressel Long-Burning Oil Founts.

The Dressel long-burning fount for signal lamps has been in use something over two years now and seems to be accomplishing most satisfactorily the object for which it was designed, viz.: reduction of the cost of maintenance of signal lamps.

The construction of the fount and burner is such as to produce a light of high candle-power that will burn for 175 hours with one filling and no attention. True parabolic reflectors are used, enabling the maximum intensity to be obtained from the light. The founts are stamped out of steel in one piece and are heavily tinned. The reflectors are made of white metal, the use of which overcomes the necessity of replating reflectors, as the metal retains its whiteness. The lamps are made with one-way, two-way and four-way reflectors, the first two being for semaphore lamps and the last for switch lamps. The first illustration shows a single-lens semaphore lamp. Where the long-burning fount is to be used in a square semaphore lamp a slide, shown in the second illustration, is furnished to hold it in a central position.

Following are the advantages claimed for these long-burning founts: Will burn seven days and nights without attention or refilling; no trimming of the wick—a simple rubbing off once a week is all that is needed; high candle-power due to true parabolic reflectors; a wick-raising device that enables the wick to be adjusted without removing the burner from the fount; the burner produces very little heat and does not smoke when turned to normal height. One hundred and fifty degree kerosene oil only should be used in these founts. They are provided with glass or mica chimneys, as desired.

The Dressel long-burning fount, which is made by the Dressel Railway Lamp Works, New York, has been adopted on the Pennsylvania, the Delaware, Lackawanna & Western, Central Railroad of New Jersey, Southern Pacific, and other prominent roads.

Motor Truck Decision.

In the suit brought by John A. Brill against the North Jersey Street Railway Company in the Circuit Court of the United States for the District of New Jersey for an injunction to prevent the use of trucks built by the Peckham Motor Truck & Wheel Company, which, was claimed, infringe patents owned by Mr. Brill, a decision was handed down on August 28, sustaining the patents. The patents involved were No. 627,898 (39 claims) and No. 627,900 (four claims), both dated June 27, 1899, covering the system of spring-suspended and semi-elliptic spring equalizers of the Brill center-pivotal trucks, No. 27-G. The Peckham trucks in controversy were those known as No. 14-B-3 and No. 16. The case was tried before Judge Bradford, District Judge for the District of Delaware, and the argument lasted four days. The court sustained the claims of both patents that were urged on behalf of the complainant, and awarded a perpetual injunction enjoining the railroad company from the use of the trucks and directing an account of profits to be taken.

THE SCRAP HEAP.

Notes.

The Missouri State Railroad and Warehouse Commissioners have issued a notice that hereafter the State weighers will have exclusive control of weighing grain in public warehouses.

At Cincinnati last week Friday it was said that the Cleveland, Cincinnati, Chicago & St. Louis had such a congestion of freight on its line from that city to Chicago that all goods except live stock and perishable were refused for one or more days.

The Southern Railroad Commissioners' Association will hold its annual meeting at New Orleans, Nov. 17, 18 and 19. The officers of this association are: N. W. Baptist, Tennessee, President; John V. Smith, Alabama, Vice-President; John A. Webb, Mississippi, Secretary; W. M. Barrow, Louisiana, Assistant Secretary.

Press despatches from Helena, Mont., say that the officers of the law have captured Isaac Gravelle, recently released from the State prison, who, with one or two others, one of whom is still in prison, concocted the plot to blackmail the Northern Pacific Railroad by means of dynamite placed on the track to destroy trains. The men hoped to use some of the expected money to secure the pardon of the man still in prison.

It was announced in St. Louis last week that the Toledo, St. Louis & Western had made a reduction of a cent and a half in the rates on grain to the Atlantic seaboard, making the New York tariff 15 cents, or only one cent above the rate from Chicago. The reduction, actual or threatened, made in the rates on grain from Omaha by the Chicago Great Western, which has just opened its line to that city, appears to be still a matter of some anxiety, and the officers of the older roads are reported to be trying to persuade the C. G. W. to make its tariffs on the same basis as those now in force by the other lines.

One Hundred and Thirty Miles an Hour.

Press despatches of October 23 report that in the speed experiments being carried out on the German Military Railroad at Zossen, Prussia, a speed of 130⅘ miles an hour was that day accomplished.

New Railroad Equipment Wanted in Belgium.

A telegram from Brussels, Belgium, says that the State Railroads are about to ask bids on 3,200 freight cars, 100 locomotives and a large quantity of other railroad supplies. Information may be had from the Bureau Central des Renseignements, Rue des Augustines 15, Brussels.

The Ferris Wheel at St. Louis.

A company has been organized to put up the Ferris wheel at St. Louis and run it during the Exposition; and the work of taking down, transportation and erection will be done by Robert W. Hunt & Co. The cost will be about $125,000. This will be the only structure from which the whole exposition can be seen.

The Urbane Country Reporter.

The new depot building of the Central New England Railroad at East Granby, Conn., has been completed and is now occupied by Station Agent Kricke and his official staff.—*Springfield Republican.*

The population of East Granby is 684. The composition of the official "staff" is thought to be either hickory or lignum vitae.

Headlights and Fogs.

Tests made a year ago by Mr. R. Quayle, Superintendent of Motive Power of the Chicago & North Western, showed that in a dense fog an oil headlight could be seen 70 ft.; a 2,000 candle power electric headlight could be seen 440 ft., while an acetylene headlight of not to exceed 100 candle power could be seen 720 ft.—*G. H. Cook, Proc. Iowa Ry. Club.*

The Pennsylvania Tunnel at Washington.

The Commissioners of the District of Columbia have formally approved amendments proposed by the company to the plans for the Pennsylvania R. R. tunnel under Capitol Hill. The plans as amended provide for elevated concrete sidewalks 3½ ft. wide, and 6 ft. above the tops of the rails, to be placed on each side of the rails in the twin tunnel, for use in case of accident and to be reached through the car windows. The part of the tunnel passing under the new building for the House of Representatives will probably be built of cut stone and ashlar masonry, instead of concrete.

Ten Men Killed in the Subway.

On Saturday night, Oct. 24, the roof of the New York City rapid transit subway caved in at Fort George, about 80 rods north of 195th street, killing 10 workmen and injuring five others. The accident occurred immediately after a blast, not excessive, and was caused by the presence of a false seam, the existence of which was unsuspected by those working below. When this seam was struck an area of rock and earth 40 ft. long by some 10 or 12 ft. wide fell very suddenly.

A Cheap and Novel Tank for Crude Oil.

The newspapers say that the Atchison, Topeka & Santa Fe has issued orders for the construction of a number of new oil tanks at different points on the line, to be built on a novel plan. If they prove a success they will replace the steel tanks now in use in California, Arizona and New Mexico. Crude oil contains a considerable percentage of asphaltum and when allowed to stand on the ground for a short period, the oil sinks into the earth to a depth of 6 or 8 in., where the asphaltum forms a crust through which the petroleum cannot pass. There can be no leakage when this process has taken place. The new plan is, therefore, to dig circular pits about 8 ft. deep and then bank up the sides to a height of 12 ft., forming a tank 20 ft. deep from which the oil will be run into the engines by gravity. The cost of constructing this style of tank is much less than for steel tanks. The latter are not fireproof; with the earth tanks the oil would be the only loss in case of a fire.

The largest of the new tanks will be constructed at Seligman and Flagstaff, Ariz., and will have a capacity of 50,000 gals. each. Two 25,000-gal. tanks are to be made at Williams, Winslow and Ash Fork. Lumber will be used for roofing the tanks, and this will be covered with tar and gravel.

Annual Meeting of the Pullman Company.

The annual meeting of the stockholders of the Pullman Company was held on Oct. 15 and the following directors were re-elected: Marshall Field, O. S. A. Sprague, Henry C. Hulbert, Henry R. Reed, Robert T. Lincoln, Norman B. Ream, William K. Vanderbilt, J. Pierpont Morgan, Frederick W. Vanderbilt, W. Seward Webb and Frank O. Lowden. The annual report of President R. T. Lincoln shows that the total revenue for the year ending July 31, 1903, was $23,120,713. The total disbursements, including operating expenses, depreciation, dividends (8 per cent.) and proportionate earnings paid associated interests were $19,622,994, which leaves a net surplus for the year of $3,497,720. The accumulated surplus is now $14,275,750. The number of passengers carried during the year was 12,321,260, and the number of car miles run was 389,254,410. During the previous year the number of passengers carried was 10,753,643, and the number of miles run was 360,602,541. This year, therefore, shows an increase of nearly 8 per cent. in miles run, and over 14 per cent. in the number of passengers carried. The total mileage of railroad covered by contracts for the operation of the company's cars is 175,761. The value of the manufactured product of the car works for the year was $22,546,878, and of rentals $338,811; a total of $22,885,690, as against $19,732,110 for the previous year. The average number of names on the pay rolls at the shops at Pullman for the year was 7,432, and wages paid, $5,123,557, making an average of $689 for each person employed. The total number of persons in the employ of the company in all departments was 20,398, and the wages paid during the year amounted to $12,137,592. The number of employees for the previous year was 19,103.

Inspecting Cars.

A car inspector should know what material in different capacity cars looks like before he starts to inspect. He must know what he is looking at and in a general way what he expects to be broken, or worn out. An old-fashioned, though excellent, scheme is for the car inspector to station himself at a point on the incoming track, where the train will pull by him, listen as the cars pass him and make a mark on cars on which he notices anything unusual. This is a good way to catch flat wheels. Jerking open oil box lids and feeling ends of journals is a good idea. A little practice will enable him to determine the brass which is not bearing properly and beginning to warm. He should mark this box and attend to it later on when through inspecting the train, and he will have fixed a hot box before it gets hot.

Seams in wheels are well understood but difficult to find. They can best be noticed while the wheel is warm, soon after stopping. The inspector should go over the roofs of cars. He cannot do much toward inspecting the tops by standing on the ground. Many persons do not attach much importance to defective running boards; but how dangerous it is for a brakeman to be running over the roof of a train and stub his toe against the end of a board sticking up perhaps only an inch above the level of the rest of the running board!

The grab-iron on the roof is all important. A man going up a ladder reaches over the corner of the roof with one hand and the instant his hand comes in contact with the grab-iron he lets loose with his other hand. If the grab-iron does not hold, then God help him. These should be looked after all the time and when a car inspector finds a suspicious grab-iron that he cannot repair, and must let the car go without repairs, he should tear it off altogether, and chalk the end of the car by the ladder. Trainmen do this, because in climbing to the top of the car a man seldom lets loose with one hand until he fastens the other, and if there is no grab-iron he will get up without it.—*J. Whelan, Yardmaster D. M. U. Ry., before the Iowa Railway Club.*

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

Iowa Railway Club.

The meeting of this club on October 20 was the largest in its history. Papers were read on the "Per Diem Basis of Car Hire," by F. A. Delano, General Manager of the Chicago, Burlington & Quincy; "Magnetism Applied to Traction," by H. F. Brown, of the Magnetic Equipment Company of Chicago; "Automatic Lock for Air-Brake on Passenger Train Cars," by John Frigden, of the Chicago Great Western, and "The Blocking of Frogs and Switches," by J. L. Dawson, of the Burlington.

Railway Signaling Club.

The Secretary announces that members attending the annual meeting at Detroit, November 10, are invited by the Michigan Central to go on a trip of inspection to see some new automatic block signals which are to be put in service on that day. These signals are on the Canada Division and the train will leave Windsor, Ont., opposite Detroit, at 9:30 Tuesday morning, returning at about 12 o'clock. The arrangements are in charge of Signal Engineer Mock, Vice-President of the Club.

Franklin Institute.

At the meeting held Thursday evening, Oct. 22, Mr. Luther D. Lovekin, of the New York Shipbuilding Company, Camden, N. J., read a paper on Modern Expanding and Flanging Machinery and Tools. The paper was illustrated with lantern slides, and machinery and tools in operation. The subject covered expanding and flanging machinery and tools for doing all classes of work from the smallest boiler tube to the largest lap-welded pipe, and in addition miscellaneous tools for placing valve seats in gate valves without using the threads, which usually cause trouble.

Railway Club of Pittsburg.

A meeting of this club was held on the 23d at the Hotel Henry, Pittsburg, Pa., the second annual meeting of the club. Mr. McConnell reviewed, in an interesting way, the work of the club since its organization in October, 1901, and then announced the election of officers as follows: President, L. H. Turner, Superintendent Motive Power, Pittsburg & Lake Erie; Vice-President, E. T. Hyndman, Master Mechanic, Buffalo, Rochester & Pittsburg, Dubois, Pa.; Treasurer, J. D. McIlwain, and Secretary, J. D. Conway, Pittsburg & Lake Erie, Pittsburg. The membership is now 414. The receipts for the year were $3,299, and expenditures $2,329.

American Society of Mechanical Engineers.

A brief outline of the programme of the December meeting has been sent out, pending the issuance of the programme which will be a little late owing to delays in the receipt of papers. The headquarters will be as usual at the Society House, 12 West 31st street, where the opening session will occur on Tuesday evening, December 1, at 9 p.m. The President, Mr. James M. Dodge, will deliver the annual address, the subject being "The Value of an Engineering Education to a Young Man." The second session will occur on Wednesday morning, at the hall of the Mendelssohn Glee Club, 113 West 40th street. This will be the business session of the convention and professional papers will also be presented. Following this, luncheon will be served at the Society House, and the afternoon will be spent in making excursions to various power stations and points of interest. The evening of this day has been left free. The third session will take place in the Carnegie Laboratory of Stevens Institute of Technology on Thursday morning at 10 o'clock. Luncheon will be served at the institute, and will be followed by visits to various points of interest in and about the grounds. The usual reception for guests and friends will be at Sherry's on Thursday evening at 9 o'clock, and will be followed by dancing and supper. The closing session will be at the Society House on Friday morning, December 4, at 10 o'clock.

The nominations for officers for the coming year, made by the nominating committee, are: For President, Mr. Ambrose Swasey, of Cleveland, Ohio; for Vice-Presidents, Prof. D. S. Jacobus, of Hoboken, N. J., Mr. M. L. Holman, of St. Louis, Mo., Mr. William J. Keep, of Detroit, Mich.; for Managers, Mr. George I. Rockwood, of Worcester, Mass., Mr. John W. Lieb, Jr., of New York City, Mr. Asa M. Mattice, of Pittsburg, Pa.; for Treasurer, Mr. William H. Wiley, of New York City.

PERSONAL.

—Mr. R. G. Seigel has been appointed Signal Engineer of the elevated lines of the Brooklyn Heights Railroad, Brooklyn, N. Y. He began his railroad service on the Chicago & Northern Pacific in 1890. Later he was on the Northwestern elevated of Chicago, where he went to the Boston elevated. This position he leaves to go to Brooklyn.

—Mr. James Chase Wilder, the new Superintendent of the Coast Division of the Southern Pacific Company at San Francisco, was born at Buffalo, N. Y., in 1857. When quite young he entered the service of the Erie Railroad, where his brother, the late F. M. Wilder, was Su-

perintendent of Motive Power. In 1879 he went west and worked for the Southern Pacific, first in the general offices and later in other places. He was then promoted to be Secretary to the Superintendent of the Western Division, and in 1900, was appointed Trainmaster for the same division. In 1901 he was appointed Assistant Superintendent, where he has remained until his recent promotion to the Superintendency of the Coast Division.

—Mr. John R. Skinner, whose appointment as Assistant Superintendent of Motive Power of the Delaware & Hudson Company is announced in another column, has for several years past been Master Mechanic of the shops at Oneonta. Mr. Skinner will, it is understood, retain this latter position. He began his railroad career with this company in 1869. In 1873 he was made Master Car Builder.

—Rear Admiral Francis T. Bowles, Chief of the Bureau of Construction and Repairs of the Navy Department, has resigned and on October 31 leaves the Government service to become President of the Fore River Ship & Engine Building Company of Quincy, Mass. The Fore River Company is now building the battleships "Vermont" and "New Jersey." Admiral Bowles was born in Massachusetts in 1858, and entered the Naval Academy in 1875. He was appointed Chief Constructor in March, 1901. Admiral Bowles superintended the construction of the battleship "Texas" at the Norfolk Navy Yard. He is an unusually able engineer and builder. Constructor W. L. Capps, now on duty at the New York Navy Yard, has been selected to fill the vacancy in the Navy caused by this resignation.

—Mr. J. L. Davis, the new General Manager of the West Virginia Northern, began his railroad service on the Baltimore & Ohio as a telegraph operator. He was later Agent and Yardmaster, and in 1893 was put in charge of the Baltimore & Ohio Terminals at South Chicago. He remained there until 1899, when he was transferred to Baltimore to superintend the Detention Bureau. Two years afterwards he was made tonnage agent. In the early part of this year he was appointed mine inspector for the transportation department and the first of this month became General Manager of the West Virginia Northern. His office is at Tunnelton, W. Va.

ELECTIONS AND APPOINTMENTS.

Ashland Coal & Iron.—The officers of this company are: President, R. Peebles; First Vice-President, Frank Coles; Second Vice-President, K. L. Butler; Secretary, and Treasurer, F. B. Moore, and Auditor, A. N. Richardson.

Baltimore & Ohio Southwestern.—John Hair, hitherto Master Mechanic at Washington, Ind., has been appointed Superintendent of Motive Power, with headquarters at Cincinnati, Ohio, succeeding J. G. Neuffer, resigned to go to the Illinois Central. (See Illinois Central below.)

Brooklyn Heights.—R. G. Seigel has been appointed Signal Engineer of the elevated lines of this company, with headquarters at Brooklyn, N. Y.

Canada Atlantic.—J. E. Walsh, Assistant General Passenger Agent, with headquarters at Ottawa, Ont., has resigned.

Canadian Pacific.—J. Nelson has been appointed Superintendent, with headquarters at North Bay, Ont. H. P. Timmerman, General Superintendent of the Ontario Division, with headquarters at Toronto, Ont., has resigned.

Chicago & Eastern Illinois.—See Nashville, Chattanooga & St. Louis.

Delaware & Hudson.—J. R. Skinner, heretofore Master Mechanic, has been appointed Assistant Superintendent of Motive Power, with headquarters at Oneonta, N. Y.

Hawkinsville & Florida.—H. E. Rodes has been appointed Vice-President and General Manager, with headquarters at Hawkinsville, Ga.

Illinois Central.—J. G. Neuffer, hitherto Superintendent of Motive Power of the Baltimore & Ohio Southwestern, has been appointed Assistant Superintendent of Machinery of the I. C., with headquarters at Chicago, Ill.

Missouri Pacific.—B. H. Mann has been appointed General Foreman of Interlocking.

Nashville, Chattanooga & St. Louis.—G. S. Pflasterer, hitherto Supervisor of Signals of the Chicago & Eastern Illinois, has been appointed Signal Inspector of the N., C. & St. L., with headquarters at Nashville, Tenn., effective Nov. 1.

Naugatuck.—W. D. Bishop, Jr., (Secretary of the New York, New Haven & Hartford), has been elected President and Secretary of the Naugatuck, succeeding his father, W. D. Bishop, resigned. The road is leased to the New Haven company.

Pacific Coast.—The headquarters of W. E. Pearce, Assistant General Manager, have been removed from Seattle, Wash., to San Francisco, Cal.

Pere Marquette.—George H. Norman, of Boston, has been elected Chairman of the Board of Directors.

St. Louis & San Francisco.—R. Mather has been elected Third Vice-President and W. H. Lyford has been appointed General Counsel. The Vice-Presidents of this company have been classified as follows: B. L. Winchell, First Vice-President, with general supervision of the affairs of the company; C. H. Beggs, Second Vice-President, with the supervision of operation and maintenance of the property; Robert Mather, Third Vice-President, with general supervision of the legal department, and A. Douglas, Fourth Vice-President, with supervision of the accounting department.

Southern.—A. L. Robertson has been appointed Master Mechanic of the St. Louis-Louisville Lines, with headquarters at Princeton, Ind.

Western Maryland.—The position of General Superintendent, held by S. M. Manifold, will be abolished, effective Nov. 1. J. H. Hyde has been elected a Director, succeeding C. W. Slagle, resigned.

LOCOMOTIVE BUILDING.

The Seaboard Air Line has ordered 30 locomotives from the Baldwin Works.

The Belgian State Railroads are about to ask bids on 100 locomotives. For information, see Car Building.

The Pennsylvania Lines West of Pittsburg will place orders during the coming year for 80 locomotives. It is stated that most of these locomotives will be built at the Altoona shops.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received the following orders: St. Louis, El Reno & Western, one freight engine; Pullman Company, one switch engine; Wisconsin & Arkansas Lumber Co., one 46-ton 10-wheel engine; Joseph Mullins Coal Company, one 43-ton engine; Chicago Heights Terminal R. R., one four-wheel switching engine.

CAR BUILDING.

The American Car & Foundry Co. has miscellaneous orders for 47 cars.

The California & Northwestern is in the market for 25 box cars and 25 flat cars.

The Atlantic & Birmingham is in the market for 300 box cars of 60,000 lbs. capacity.

The Hornos R. R. of Mexico has ordered several box cars from A. Baldwin & Co., New Orleans, La.

The Canada Atlantic is reported to be asking bids for 25 flat cars to be built at the company's shops.

The Atchison, Topeka & Santa Fe has ordered 100 tank cars from the American Car & Foundry Co.

The St. Louis Southwestern is having 35 coaches built at the St. Charles Works of the American Car & Foundry Co.

The Atchison, Topeka & Santa Fe is having 525 cars built at the Chicago Works of the American Car & Foundry Co.

The Findlay Terminal R. R., Findlay, Ohio, has ordered 30 steel underframe tank cars from the American Car & Foundry Co.

The American-China Development Co. has ordered 10 passenger coaches and five baggage cars from the Wason Mfg. Co., Springfield, Mass.

The Belgian State Railroads are about to ask bids on 3,200 freight cars. Detailed information may be had at the Bureau Central des Renseignements, 15 Rue des Augustins, Brussels, Belgium.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received the following orders: Illinois Terminal, one passenger coach; Toledo, St. Louis & Western, two first-class coaches; Ward & Wade, one private theatrical car.

The Brooklyn Rapid Transit is reported as having 52 baggage cars and seven express cars built at the Middletown Car Works. These cars are to be built so that they may be run by means of either the third rail or overhead trolley.

The Cincinnati, New Orleans & Texas Pacific, as reported in our issue of Oct. 2, is in the market for 500 box cars, 700 coal cars, 100 coke cars and 50 stock cars, all of 60,000 lbs. capacity. It is unofficially stated that the contract for these cars has been let, but confirmation of this has not yet been received.

BRIDGE BUILDING.

ALLIANCE, OHIO.—A bridge is to be built by Stark County 150 ft. long and 32 ft. wide, to replace the old Gaskill bridge over the Mahoning River.

BELVIDERE, N. J.—Bids may soon be asked for a new bridge to cost about $25,000 to replace the one recently destroyed by flood.

BIRMINGHAM, ALA.—The County Board, it is reported, will build county bridges to the amount of about $35,000 this year.

BROWNSVILLE, TEXAS.—It is reported that the St. Louis, Brownsville & Mexico and the National of Mexico will jointly build a bridge over the Rio Grande at this place.

CHICAGO, ILL.—An agreement with abuttors has been reached by the Chicago & Alton respecting the proposed viaduct over Western avenue. The consent of the South Park Board has yet to be obtained.

EASTON, PA.—The Riegelsville Bridge Company will build a new steel bridge at Easton to replace the bridge recently destroyed by high water.

GATES, N. Y.—The Court of Appeals has affirmed the orders of the Railroad Commissioners directing the town of Gates to abolish grade crossings at Buffalo road, Field and Kossuth streets. It is estimated that this work will cost about $100,000. The railroad is to pay half the expense, and the State and town the remainder.

GRATZTOWN, PA.—A new bridge will be built over Sewickley Creek at this place.

HARRISBURG, PA.—Bids are wanted Nov. 10, by Jas. M. Shumaker, State Superintendent of Public Grounds and Buildings, for the rebuilding of the substructure and superstructure of the bridge over the Shamokin Creek near Sunbury.

JORDAN, N. Y.—A bridge to cost about $25,000 may be built over the Seneca River to replace the present structure.

LAWRENCE, KAN.—An appropriation of $25,000 has been made and bids may soon be asked for the building of the Eudora bridge.

LEAVENWORTH, KAN.—Bids are wanted by the Board of County Commissioners, Nov. 2, for building three county bridges. J. V. Niehaus, County Clerk.

LOS GATOS, CAL.—A bridge of steel, or a stone arch, may soon be built for the joint account of the town and the railroad company, at a cost of about $12,000.

NASHVILLE, TENN.—A movement has been started by residents of the northeast section of the city for the building of a viaduct over the Louisville & Nashville yards from the terminus of Stewart street and connecting with Fourth street, to reach from Spring street on the north, to Factory street on the south.

NEW CASTLE, PA.—The city will urge the project for building a viaduct at a cost of $175,000 over the Shenango River and to abolish a grade crossing over about 20 railroad tracks, the cost to be borne by the city, the county and the railroads interested.

NEW YORK, N. Y.—New bids are asked by Commissioner Lindenthal, until noon, Nov. 5, for the material, the plant, and the construction of the steel superstructure of the new Blackwell's Island bridge. Security for $1,000,000 is required and the work must be completed on or before Jan. 1, 1907, as advertised in the *Railroad Gazette*. The one bid filed on a former date has been rejected.

Bids are wanted by Gustav Lindenthal, Commissioner of Bridges, until Nov. 12, for furnishing all the labor, materials and plant necessary for the construction of the foundations, piers and abutments of Pelham bridge over the East Chester Bay in Pelham Bay Park, Borough of Bronx, as advertised in the *Railroad Gazette*. Seventy thousand dollars security is required and the entire work must be completed by Dec. 1, 1904.

Bids are wanted by Gustav Lindenthal, Commissioner of Bridges, until Nov. 5, for the building of a pivot pier on a pneumatic foundation, a pile fender and dredging for the Fordham Heights bridge over the Harlem River, as advertised in the *Railroad Gazette*. Security to the amount of $50,000 must be given, and the work begun within 10 days from the date of notice given by the Commissioner to begin work, and completed by July 1, 1904.

Bids are wanted Nov. 6, by Gustav Lindenthal, Commissioner of Bridges, for the grading, paving, etc., of the Williamsburg bridge over the East River, as advertised in the *Railroad Gazette*. Work must begin in 20 days and be finished in 90 days. Security for $20,000 must be deposited.

PULASKI CITY, VA.—An iron bridge will be built at once to replace the structure which recently collapsed.

ROGERS, ARK.—The County Court has appointed a committee to select a site for the steel bridge to be built over the White River. It is reported J. A. Murray, of Bentonville, is one of the committeemen.

SCRANTON, PA.—The Common Council has passed an ordinance providing for a bridge over the Lackawanna River at Sanderson avenue. The mayor has determined that the plans of all bridges to be hereafter built over the Lackawanna River within city limits must be approved by the city's engineering bureau. The Director of Public Works has been ordered to see that the plans for the new Ontario & Western bridge at Green Ridge be approved before work is commenced.

STERLING, ILL.—The bids received Oct. 14 for the bridge over Rock River for the completed substructure and superstructure were: Clinton Bridge & Iron Works, Clinton, Iowa, $16,888 and $47,500; Modern Steel Structural Company of Waukesha, Wis., $15,682 and $49,887; Lafayette Engineering Company, Lafayette, Ind., $16,100 and $50,200; Joliet Bridge & Iron Company, Joliet, Ill., $11,623 and $50,800. Bids for the superstructure without sidewalks were: Wisconsin Bridge & Iron Company, Milwaukee, Wis., $43,000; Midland Bridge Company, Kansas City, Mo., $48,125; Penn Bridge Company, Beaver Falls, Pa., $38,600; W. J. McAlpine, Dixon, Ill., $39,463; Clinton Bridge & Iron Works, $40,500; Elgin Construction Company, Chicago, Ill., $41,000; Modern Steel Structural Company, $40,153; Bloomington Bridge & Mfg. Co., of Bloomington, Ill., $42,000; Lafayette Engineering Company, $42,200; Joliet Bridge & Iron Company, $42,490; Canton Bridge Company, Canton, Ohio, $44,000; King Bridge Company, Cleveland, Ohio, $49,900. The bids for a concrete bridge, with one and two walks, by the Clinton Bridge & Iron Works was $57,500, $62,500 and $72,000. Other bids for a concrete bridge with two walks were: Illinois Bridge Company, Chicago, Ill., $65,000, and the Chicago Engineering & Construction Co., Chicago, Ill., $160,000. Fred. R. Stoddard, Town Clerk. (Oct. 10, p. 729.)

THOMASVILLE, GA.—Bids are wanted by E. M. Smith, Chairman of Thomas County Commissioners, Nov. 3, for the building of a steel bridge of one span 108 ft. long, with 12-ft. roadway, and cylinder pier 30 ft. long, at Jone's bridge over the Ochlockonee River.

VAN BUREN, ARK.—The St. Louis, Iron Mountain & Southern, it is reported, is taking soundings for a new bridge over the Arkansas River.

VICKSBURG, MISS.—Bids are wanted by J. D. Loughlin, clerk of the Board of Supervisors, Nov. 2, for building a steel bridge over Magnolia Bayou; also for building a steel bridge over Pace's Bayou.

WHEELING, W. VA.—Press reports state that the Wheeling Traction Company will build its new bridge at a cost of several hundred thousand dollars over the back river, for the purpose of shortening the route between Wheeling and Bellaire, Ohio.

YORK, PA.—The York Haven Street Railway Company has given a contract to Lindsay & Company, of Philadelphia, to build a 600-ft. concrete bridge, with iron piers, over the Big Conewago Creek at a cost of about $11,500.

Other Structures.

ALLANDALE, ONT.—The new freight house to be built by the Grand Trunk at Allandale will cost about $60,000. Coal pockets of about 20,000 tons capacity will also be built.

GRANGER, TEXAS.—The Missouri, Kansas & Texas will build a reservoir with a capacity of 30,000,000 gallons of water at this place. The company will also build a new passenger station.

HARRISBURG, PA.—A permit has been issued to the Pennsylvania R. R. to build an electric power house on Seventh street, near Calder. The building is to be of brick and to cost about $13,000.

JACKSONVILLE, FLA.—Bids are wanted until Nov. 19, by Francis R. Shunk, Captain U. S. Engineers, Jacksonville, Fla., for dredging and building a stone breakwater in Biscayne Bay, Fla.

MEADOWS, N. J.—An officer of the Pennsylvania is re-

ported as saying that the Meadows shops will not be removed to Trenton, and that the company is spending about $250,000 in improving a number of the buildings. The land bought at Trenton will be used for building other shops, probably next year.

Mobile, Ala.—The Louisville & Nashville, it is reported, is making plans for building a brick freight house. The Terminal Railway Company, it is reported, will build the union station at Government and Monterey streets.

Montreal, Que.—The Dominion Government, it is reported, will build new stations—one at Montapedia to cost $8,000, and one at Windsor to cost $10,000; also a new engine house at Chaudiere Junction to cost $33,500, on the route of the Intercolonial Railway.

Nashville, Tenn.—Bids will be received Nov. 9 by Colonel C. B. Sears, U. S. Engineer in charge of river improvements, at Nashville, for steel lock gates at locks A and 1, on the Cumberland River.

Navasota, Texas.—It is reported that the Gulf, Colorado & Santa Fe and the Houston & Texas Central will soon begin the building of a new union passenger station.

New York (Borough of Brooklyn).—The Brooklyn Rapid Transit Company has bought 30 lots on West Fifth street, Coney Island, for a terminal. A new station will be built.

Norfolk, Va.—Local reports state a syndicate is to be formed which will build a steel pier 400 ft. long, to cost about $75,000, at Virginia Beach.

Philadelphia, Pa.—The Philadelphia & Reading, local reports state, will build in Philadelphia a shop to repair steel cars.

Williamson, W. Va.—The Norfolk & Western, local reports say, will build about 75 houses for the workmen in the neighborhood of its shops at Williamson.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—President Ripley is reported to have said that as soon as the situation in Wall street is cleared a 250-mile cut-off will be built to shorten the main line of this railroad between La Junta and Albuquerque. The new line will start at Belin, N. Mex., 30 miles south of Albuquerque, and run east to Texico, Texas.

Bennettsville & Cheraw.—This road has been completed from Bennettsville, S. C., to Cheraw, 14 miles. The road will be opened for traffic at once and will be operated by the Chesterfield & Lancaster. W. F. Stevenson, Cheraw, S. C., is President of the latter company. (See Construction supplement.)

Birmingham & Lineville.—Articles of incorporation have been filed by this company in Alabama to build a railroad from Lineville west to Pyrites, Clay County, eight miles. S. E. Thompson, R. H. Pearson, J. S. Jemison and V. S. Allen, Birmingham, Ala., and R. L. Ivey, Lineville, Ala., are incorporators.

Buffalo & Susquehanna.—See Railroad News.

Buffalo, Rochester & Pittsburg.—It is reported that this company will rebuild part of its middle division from Brockwayville, Pa., northeast to Ridgway, 18 miles. The work will include several tunnels and the elimination of a number of curves. J. M. Floesch, Rochester, N. Y., is Chief Engineer.

Charlotte, Monroe & Columbia.—An officer writes that the extension from Hamburg, S. C., to Jefferson, 11 miles, has been completed. The line will be put in operation for freight and passenger service about Nov. 1. Ernest Williams, Lynchburg, Va., is President. (May 29, p. 384.)

Chicago & Wabash Valley.—A petition has been filed by this company with the Secretary of State, asking for permission to extend its line north from the present terminus at Kersey, Ind., northwest to a point in Lake County, 10 miles. B. J. Gifford, Kankakee, Ill., is President.

Chicago, Burlington & Quincy.—See Jacksonville & Concord.

Coal & Coke.—A contract has been let to the Ferguson Contracting Company, of Pittsburg and New York, for building an 11-mile extension from Little Otter, in Braxton County, W. Va., northeast in the direction of Elkins. The contract includes two tunnels.

Craddock & Burnsville.—Incorporation has been granted this company in West Virginia to build from Craddock northwest to Burnsville, 25 miles. Connection will be made with the Baltimore & Ohio at both points. H. H. Lewis and G. S. Lewis, of Newlonton, W. Va.; C. A. Cutright, Buckhannon; W. E. Hamner, Clarksburg, W. Va., and others are incorporators

Delaware & Hudson.—Press reports state that this company will build from Tekene Junction, N. Y., east to a connection with the Chateaugay R. R., six miles. An officer is reported as saying that the company has no intention of building to St. Regis Falls to connect with the New York & Ottawa.

Grand Trunk Pacific.—The incorporation act of this company has been passed by the Senate and received the Royal Assent. This places the matter in a position where the company can be organized and make the necessary preparations for beginning work. There have been from 15 to 20 survey parties in the field since spring, distributed from Lake Superior to the Pacific Coast. The western portion of the road will be built by the Grand Trunk Pacific, and the line from Moncton to Winnipeg will be built by the Government and handed over to the Grand Trunk for 50 years free of charge. The whole work will cost about $100,000,000 and will take about five years to build.

Hamburg & Western.—It is reported that this company will soon begin work on a railroad from Lake Providence, La., north through Hamburg and Monticello to Pine Bluff, Ark., 100 miles. J. M. Parker and J. C. Norman, Hamburg, Ark., are interested.

Hoboken & Manhattan.—This company has been incorporated in New Jersey to build a tunnel from Jersey City to New York. W. G. McAdoo, E. F. C. Young, C. L. Corbin, F. B. Jennings and others are incorporators.

Illinois Central.—It is officially stated that, owing to the high price of materials and the inability of this road to secure the necessary workmen, work on the second track from Fulton, Ky., south to Memphis, will be suspended until conditions improve. (March 27, p. 240.)

Imboden & Odell.—Contract for building 13 miles of this proposed railroad from the mouth of Blue Creek east to Summersville, W. Va., 31 miles, has been let to Reynolds & Sterling. The contract calls for the completion of this part of the line by May 1, 1904. C. P. Peyton, Charleston, W. Va., is Chief Engineer. (Oct. 16, p. 750.)

Iowa City, Kalona & Washington (Electric).—The organization of this company in Iowa has been completed. The headquarters will be at Washington, and the company will soon begin work on an electric railroad from Iowa City south through Kalona to Washington, 35 miles. G. C. Rodman, Washington, Iowa, is President. (Sept. 18, p. 680.)

Jacksonville & Concord.—This company, which was recently incorporated in Illinois by Chicago, Burlington & Quincy interests, has begun work on its road from Jacksonville northwest to Concord, 10 miles. (Oct. 7, p. 714.)

Joliet, Plainfield & Aurora.—This company has completed 10 miles of its line from Joliet, Ill., to Plainfield. Contracts for grading the remaining 10 miles from Plainfield to Aurora will shortly be let.

Mexican Roads.—It is reported that the Mexican Government has granted a concession to the owners of the Lluvia del Oro mine for building a railroad from San Andres del Oro, in the State of Chihuahua, Mexico, west to the port of Topolobampo, on the Pacific coast.

Minneapolis, St. Paul & Sault Ste. Marie.—Grading has been completed for a distance of 86 miles on the extension from Glenwood, Minn., north to the White Earth Indian Reservation in Norman County. Twenty miles of track have been laid on this extension. (Sept. 4, p. 642.)

Minnesota Central.—This company has been organized, with a capital of $3,000,000, to build a railroad from Mankato, Minn., northeast through St. Cloud to Duluth, 200 miles. It is stated that bonds amounting to $2,000,000 and covering 110 miles, have been accepted by a New York firm. D. H. Beecher, Grand Forks, N. Dak., is President; E. H. Mackenzzie, Gaylord, Minn., is Secretary, and H. B. Cady, Minneapolis, is Treasurer.

Morgantown & Kingwood.—Surveys are reported completed for an extension from Bretz, W. Va., north to Rowlesburg and Kingwood, 30 miles. A. S. Brady, Fairmount, W. Va., is Chief Engineer.

Nashville, Chattanooga & St. Louis.—It is reported that grading is completed on the branch line of this road from De Rossette, Tenn., to Eastland, seven miles, and also on the branch from Tracy City to Nunnelly Ridge, 6½ miles. (April 3, p. 256.)

National of Mexico.—The Mexican Government has granted a concession to this company to build a branch from Salamanca northeast to San Juan, 40 miles, both places being in the State of Guanajuato. The concession states that 10 miles must be completed within 18 months, and the remainder within five years.

New York Central & Hudson River.—Maps and plans have been filed with the Board of Estimate of New York city for a change in the route of the main line between East 191st street and Spuyten Duyvil. A sharp curve of over two miles and seven grade crossings will be abolished. The present right of way will be abandoned and ceded to the city, and the tracks will be relaid along the more direct course of the ship canal.

North Branch Terminal.—Articles of incorporation have been filed by this company in Illinois, to build a railroad four miles long, from Lincoln avenue, Chicago, north to Oakley avenue, and to the north branch of the Chicago River. B. F. Weber, J. W. Turner, G. F. Goldman, P. O. Stensland and others of Chicago are incorporators.

Oregon R. R. & Navigation.—It is reported that this company will complete its extension from Dayton, Wash., to Pomeroy, 26 miles. Ten miles of the line have already been built.

Pennsylvania.—This company has awarded a contract to H. S. Kerbaugh for rebuilding and enlarging the yards of the Buffalo & Allegheny Division at Coleman, Pa., at a cost of about $750,000. Contract has been awarded to Drake & Stratton for building the Axleton branch at a cost of about $500,000. Contract for building one of the approaches to the Port Perry bridge has also been awarded to H. S. Kerbaugh.

The new Portage low-grade line has been opened for traffic. It leaves the main line at Bennington, the eastern end of the Gallitzin tunnel, and follows a southeasterly course to Duncansville, thence through New Portage and Hollidaysburg to Petersburg, where it rejoins the main line. The road is 18 miles long, and is double track the entire distance, and is to be used for freight to relieve the present congestion on both sides of the Alleghanies. It avoids the heavy grade near Altoona and the famous horse-shoe curve.

Raleigh & Eastern North Carolina.—It is reported that the Capital Construction & Development Company has been organized in North Carolina to build this proposed road from Raleigh, Wake County, in an easterly direction via Wilson and Greenville, to Washington, and eventually to tidewater on Pamlico Sound, 100 miles. E. B. Barbee, Raleigh, N. C., is one of the incorporators. It is said that grading will be begun early in December. (June 12, p. 416.)

Southern Indiana.—It is stated that this company will build an extension from Terre Haute north to Chicago, 150 miles. Connection will be made with the Chicago Terminal Transfer Company at Chicago.

Southern Pacific.—The new Santa Susana tunnel, 7,369 ft. long, on the Chatsworth cut-off of the San Francisco-Los Angeles Coast Line, will be opened for traffic about January 1. No attempt will be made to reduce the time over the present Saugus route until the new track along the Chatsworth cut-off is in proper shape for fast running.

Stockton Southeastern.—Articles of incorporation have been filed by this company in Missouri. It is proposed to build a railroad from Eldorado Springs, Cedar County, Mo., southeast to Stockton, 20 miles. Connection will be made with the Missouri, Kansas & Texas at Eldorado Springs. G. F. Wolfe, Kansas City, Mo., is President, and G. A. Loeffler, Secretary.

Suffolk & Carolina.—Surveys are reported in progress for an extension from the present terminus of this road at Edenton, N. C., northeast to Gatesville, 30 miles. The new line will parallel the South Carolina & Georgia extension. W. H. Bosley, Baltimore, Md., is President.

Thunder Bay, Nepigon & St. Joe.—The Dominion Government has given this company a bonus of $160,000 for its proposed road from Port Arthur, Ont., in a northeasterly direction a distance of 50 miles. Bids for grading the first 30 miles are now being asked and work will be begun at once.

Virginia Roads.—It is stated that the Buena Vista Extract Works, in Rockbridge County, Va., will build a narrow gage railroad from Vesuvius east to Montebello, eight miles. Connection will be made with the Norfolk & Western at Vesuvius.

Wisconsin Central.—At a recent meeting of the stockholders of this company it was voted to build a cut-off from Chippewa Falls, Wis., southeast to Marshfield, 65 miles. Surveys have been finished for this line and grading will shortly be begun.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—At the next general meeting of this company on Dec. 4 at Topeka, Kan., the stockholders will be asked to approve the purchase of the San Francisco & Northwestern, the Phœnix & Eastern, the Oakland & East Side and the Randsburg railroads.

Buffalo & Susquehanna.—The report of this company for the fiscal year ending June 30 shows gross earnings of $1,000,752, an increase of $165,004. Operating expenses increased $89,814, leaving an increase in net earnings of $75,190, or 21 per cent. Freight earnings increased about 19 per cent., and passenger earnings about 15 per cent. The revenue ton mileage increased from 37,757,996 tons to 43,517,126 tons, and the average revenue per ton per mile increased from 1.84 cents to 1.89 cents. Changes in the maintenance departments and conducting transportation were slight, showing small general increases. After payment of interest charges, rentals, etc., the net income was $384,890, an increase of $139,674. The report states that work is now in progress on the new line in Pennsylvania, connecting the present main line with Sykesville, midway between DuBois and Punxsutawney, a distance of 55 miles. It is expected that the road will be completed as far as Tyler and DuBois before Jan. 1, 1904. Surveys for the line from Wellsville to Buffalo, 85 miles, have been finished and work will be begun very shortly.

Canadian Pacific.—At the recent meeting of shareholders of this company the purchase of the Kingston and Pembroke, running from Renfrew on the C. P. R main line to Kingston, the lease of the Calgary and Edmonton, and the agreement to complete the Lindsay, Bobcaygeon and Pontypool were ratified. The extension of the Manitoba & North Western, and the purchase of the Elder, Dempster Co.'s Canadian Atlantic fleet for $9,087,500, were also confirmed.

Gulf & Ship Island.—Over the same average number of miles operated gross earnings for the last fiscal year increased from $1,374,684 to $1,705,047, and operating expenses from $940,514 to $1,079,618. Net earnings were $625,429, with a percentage of operating expenses of 63.32 as against net earnings of $434,170 last year, with operating expenses 68.42. From net earnings were subtracted an interest charge of $195,430, and a one per cent. dividend of $100,000, leaving a surplus of $333,718 which was used partly to increase the reserve fund, and partly for construction work not provided for by the company's $5,000,000 bond issue. Freight and passenger earnings increased about 25 per cent., due to a steady growth in business, and increased facilities at Gulfport, the southern terminus of the road. As an example of the growth of this port, it is interesting to note that during the past year 56 vessels, of which 20 were steamships, loaded at Gulfport, as against 21 vessels in 1902. The funded debt of the company was increased during the year from $3,087,000 to $4,607,000, the increase being used for work on docks, channels and wharves at Gulfport and for new equipment. For improvements carried out by this company at Gulfport, see *Railroad Gazette*, July 31, p. 550.

Illinois Central.—At a recent meeting of the stockholders, it was voted to issue $20,000,000 bonds for the purpose of refunding the indebtedness of the company, and to pay for the construction of new lines and improvements on the main line. These bonds are to pay a rate of interest not exceeding 4 per cent., and the mortgage will cover 13 subsidiary lines of the Illinois Central.

Lake Street Elevated (Chicago).—This company, the capital of which is $10,000,000, has been placed in the hands of a receiver on application of two stockholders, James Bolton and D. F. Crilly. The action taken asking for the appointment of a receiver appears to have been approved by a majority of the directors. In the bill which has been filed it is alleged that the company is insolvent, due to reckless extravagance and to mismanagement. The Equitable Trust Company has been appointed receiver. The present officers are C. A. Knight, President; W. W. Miller, Vice-President, and W. B. Griffin, Secretary and Treasurer.

Mississippi River & Bonne Terre.—The capital stock of this company was recently increased from $600,000 to $2,500,000. The road extends from Riverside, Mo., to Doe Run, 47 miles, and has outstanding $500,000 first mortgage bonds. J. Wyman Jones, 55 Liberty street, New York City, is President.

Northern Pacific.—This company has declared a regular quarterly dividend of 1½ per cent., and an extra dividend of one-half of 1 per cent., making 7 per cent. paid during the calendar year of 1903. The first extra dividend of one-half of 1 per cent. was paid last February.

Portland, Vancouver & Yakima.—See Washington Railway & Navigation Company below.

St. Louis & San Francisco.—The report of this company for the fiscal year ending June 30 shows gross earnings of $24,289,510, an increase of $2,668,628. Operating expenses were $15,875,977, an increase of $2,403,506, leaving an increase in net earnings of $265,122. Surplus carried to profit and loss account was $634,975 as compared with $1,472,197 in the previous year. With regard to the small increase in net earnings, President Yoakum says: "In consequence of the considerable new mileage opened for traffic during the year, the increase in our fixed charges is temporarily somewhat out of proportion to net earnings. The territory through which the new lines pass is being rapidly developed." During the year the company took over the St. Louis, Memphis & Southwestern, the St. Louis & Gulf, the Ozark & Cherokee Central, the Shawnee, Oklahoma & Missouri Coal & Ry. Co., and the Chicago & Eastern Illinois.

Torres & Prietas.—Press reports state that this Mexican railroad has been sold to a St. Louis syndicate. The road runs from Prietas to Torres, 16 miles. It is stated that an extension will shortly be built to the mining districts in the Yakima River country. F. H. Seymour, Torres, Mexico, is General Manager.

Washington & Oregon.—See Washington Railway & Navigation Company below.

Washington Railway & Navigation Company.—This company has recently been formed by the consolidation of the Washington & Oregon, which runs from Kalama, Wash., to Vancouver, 28 miles, with the Portland, Vancouver & Yakima, which runs from Vancouver to Salmon Creek, 14½ miles.